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The President's Plan

IT is now a full month since the President submitted his well balanced plan for establishing our merchant marine.

He is to be congratulated on the fact that, although this plan contains many forms of indirect aid as well as a subsidy, no one has been able to suggest any better way to develop our shipping. Few if any cases of proposed legislation have been so admirably framed to disarm criticism and few cases are on record where the necessary legislative steps have proceeded so rapidly to carry out a President's recommendations.

The reason for this lies in the provisions that are made in the plan to benefit the exporter and importer, as well as the shipowner, to encourage the construction of ships as well as their operation, and to build up a naval reserve, thus insuring an efficient support for our warships as well as a highly trained better paid class of seamen. In fact, the President's message is more than a plan, *it is the greatest "selling" argument for an American merchant marine that has ever been presented to the American people.*

It is a selling argument to the shipper, the manufacturer or the producer, whether he exports or imports finished or raw materials, for it is plain even "to the man on the street" that whosoever routes his traffic under this plan in American bottoms may make a straight deduction of 5 percent of the freight money that he pays from his income tax.

It is a selling argument to the shipowner and the prospective shipowner for it guarantees him, in the direct subsidy, the same kind of protection against cheap foreign labor that has built up our other industries. Strange as it may seem, the shipowner, or the prospective shipowner, is the most important man to be convinced that the merchant marine can be made a profitable business for otherwise *he will neither buy nor build the ships* that are needed to adequately represent us on the Seven Seas.

It is a selling argument to the shipbuilder for it provides for a large construction loan fund at a cheap rate of interest, making it possible for responsible parties to borrow the money to construct the most modern and efficient vessels of the types that we lack, such as fast passenger and mail liners, motorships and refrigerator ships. It provides exemptions from taxes, if the money is spent in new construction in American yards. But most of all it specifies that except in very special cases no benefits under this plan will go to vessels other than *those built in our own shipyards.*

It is a selling argument to good American seamen for it assures them an American standard of wages through the creation of a naval reserve. Their uniform will bring them a certain glory and a certain respect that only those who stand ever ready to serve their country in time of need can ever expect. It is due more to this practice of England than anything else that has caused *her best type of citizens to follow the sea.*

It is a selling argument to all patriotic Americans for they cannot have forgotten how the cry went out "for ships and more ships" when the deadly submarines were at their nefarious work. They know right down in the bottom of their hearts that an adequate naval reserve of merchant ships is absolutely necessary for *the very safety of their country.*

It is a selling argument to the taxpayer for it provides a close check on the profits of the shipowner and for the return to the Treasury of excess earnings. Not only this, it provides an opportunity for the Government to sell its ships which

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can be nothing else than a heavy drain on the Treasury as long as they remain idle. In fact, under this plan the *Government should take in more money from the sale of its ships than it pays out* in subsidies for some years to come.

The President has done his part, Congress will no doubt follow suit but the great mass of people do not read a presidential message as closely as they should. The Shipping Board and the shipowners who know how much benefit the whole country will receive from a merchant marine should get together and devise some means of spreading the gospel of shipping throughout the nation.

The Cost of Supporting Foreign Shipping

COMMISSIONER George E. Chamberlain of the Shipping Board gave some very interesting figures in a recent speech before the National Merchant Marine Association on the amount of money that foreign shipping interests had taken out of this country. Perhaps if the newspapers which have repeatedly suggested in their editorials that if foreign ships could carry our cargoes cheaper than American vessels it would be good business to let them do so, and that it would, in fact, help those countries to pay up their debts, were aware of the stupendous sums that we have paid for transportation, they would not let insidious foreign propaganda bias their judgment again.

Commissioner Chamberlain's figures, obtained from the Department of Commerce, show that during the six years ending December 31, 1920, the total value of our exports and imports was $47,626,671,810, and of this amount $12,-129,630,431, or 26 percent of the total, was carried in American vessels. Foreign ships, on the other hand, carried commerce valued at $35,497,041,379, or about 74 percent, and of this amount, Great Britain carried $19,811,387,710, or about 42 percent of the total commerce. Taking 25 percent of the total value of the commerce as a conservative estimate of the cost of freight, banking, insurance, etc., paid out for foreign services, the money actually going out of this country to enrich foreign shipping interests in the last six years amounted to $8,874,260,345.

Although it is difficult for us to appreciate the immensity of the vast sums that must be paid out for transportation of our commerce, it requires no stretch of the imagination to note that the $8,874,260,345 paid to foreign shipping in the last six years would come pretty near to cancelling the total allied war debt to us and that in the event that we fail to properly develop our merchant marine a much smaller sum than this expended on foreign shipping every six years would more than pay our entire national debt in far less time than America, rich as she is, can possibly hope to liquidate it.

Those who advocate allowing foreign ships to handle our commerce, providing they can do it cheaper, and who think that the amount of money involved is of no relative importance would get a truer perspective of the necessity for an American merchant marine, if they would compare the total savings deposits of approximately $6,000,000,000 which represents the lifetime accumulations of our working people with the nearly $9,000,000,000 expended on foreign ships in six years.

If this is not enough to impress any fair minded American with the vastness of the sums that a merchant marine of our own would retain in this country, let him stop to consider the fact that the total amount of cash expended by the Federal Government to date on the improvement of its rivers, harbors, canals, including the Panama Canal and its fortifications, is only $1,515,931,141.33—a sum which foreign ships would carry away in three or four years of normal trade.

Commissioner Chamberlain says that he does not think that it is an exaggerated statement to say that foreign interests have been enriched by over twenty-eight billion dollars by carrying American commerce in their ships during the last one hundred years notwithstanding the fact that we carried a very large portion of our commerce in our own ships up to 1860. Outside of the many other valid arguments for an adequate merchant marine, the amount of money that our own ships can retain in this country is an ample reason for supporting the President's plan of Government aid to our merchant shipping.

Shipping Bill Making Progress

AS a result of the efficient cooperation of the Shipping Board with the Senate Committee on Commerce and the House Committee on the Merchant Marine and Fisheries, there was introduced in both Houses of Congress, on the same day that the President delivered his message, identical bills to amend and supplement the Merchant Marine Act of 1920 embodying the Administration's recommendations for the purpose of aiding and establishing our merchant shipping.

This close cooperation was possible because the President was assisted in the preparation of his message by the facts bearing on our merchant marine that had been collected by the United States Shipping Board who in turn had been assisted by committees consisting of eleven of the best known shipping experts in this country. It is a striking tribute to the broad minded character of the personnel of the Shipping Board, composed as it is of three Democrats and four Republicans, that the findings presented to the President received the unanimous support of that body. Few, if any, know the politics of the eleven experts and it is said that the board itself was ignorant of the political affiliations of its advisers.

Thus the Shipping Bill, which is analyzed on page 219 of this issue, has been constructed by men having the patriotic purpose of securing the best information possible relating to marine matters from the best possible sources. That the work was well done is evident from the unqualified endorsement of the President's message by the convention of the National Merchant Marine Association on March 4. At this convention, which was attended by prominent men representing all branches of shipping, no criticism of the provisions of the Shipping Bill were made although one session was an open forum maintained for the very purpose of debating the provisions of this bill.

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There are always bound to be honest differences of opinion in any group of people as to the best means to accomplish a great object and shipping men in the past have been no exception to this rule. However, the necessity and demand for an immediate decision on a constructive marine policy has become so great that criticism of the Administration's plan demands a suggestion of something better. It is a good bill and the indications are that it will receive the support of both Republicans and Democrats.

The Cart Before the Horse

THE natural way for a country to develop its merchant marine is to establish merchandising and banking connections abroad and then to construct its ships as fast as they are needed to handle the business obtained. The reason that this method has not been applied to any large extent by this country in the past lies principally in the far greater rewards offered to capital for domestic investment.

It was hardly to be expected, with the opportunities for exploiting our natural resources or engaging in our highly protected industries, that capital could see any attraction in shipping—our one and only free trade experiment. We did not realize that our periodical business depressions were in a large part due to the backing up of surplus products that could have been marketed in foreign countries, if we had had the business connections and an adequate merchant marine to dispose of our excess production.

Of course, if it had not been for the war we would not have built our great fleet before establishing business connections throughout the world; thus getting the cart before the horse. But we have the ships now—ready for business—and we have got to develop the traffic for them or suffer a heavy deficit until we do.

If the knowledge that our surplus vessels will cost us tremendous sums of money unless we find cargoes for them, together with the growing realization of the necessity of an adequate merchant marine both in time of peace and in time of war, is a sufficient incentive to induce us to go after foreign trade in the characteristic American fashion, then these vessels will indeed be a blessing. The opportunities for development and expansion in this country are growing less each year and America cannot take its proper place in the world, if it neglects the opportunity to secure its share of the foreign trade which can only be accomplished through American agencies and an American owned and operated merchant marine.

Joseph W. Powell

A VOTE of thanks is due to Joe Powell, as he is familiarly known in the shipbuilding industry, for the valuable assistance that he has given to the Shipping Board and to the country during the past seven months. We say seven months, because, although he resigned the position of President of the Emergency Fleet Corporation on March 4, he then accepted a final commission to inspect the ex-German passenger ships for the purpose of determining which of these vessels it would pay to recondition. His report on this matter, in view of the dearth of passenger vessels under the American flag, will be read with interest.

It is understood that Mr. Powell was very reluctant to accept a position with the Shipping Board as he was probably well aware of the acrimonious criticism that had been constantly directed against the men holding similar jobs in the past but when Mr. Lasker personally asked him if he would not come down to Washington for a short time and help straighten things out, Mr. Powell could not refuse, and so he agreed to accept the job for three months on condition that his service would be gratuitous.

At the end of three months, he agreed to a like extension and it was probably largely due to this extension that Mr. Lasker was able to place before the sub-committee on appropriations a more complete analysis of the condition and needs of the Shipping Board than that committee had ever received before from any Government department.

Mr. Powell has been a strong advocate of a protected merchant marine. He has always claimed that our shipping was an asset—not a thing to be salvaged—and that without it the United States could not take its proper place among the nations of the world. We feel that the critical period of our merchant marine has passed and that slow and sure development along the lines that Mr. Powell has urged is now in sight.

Keep The Government Out Of Ship Repairing!

ONE of the greatest reasons why the Shipping Bill will be passed by the present Congress is that, by granting the direct and indirect aids that are necessary to influence private capital into embarking on shipping ventures, the Government will be able to sell its ships and thereby put a stop to the monthly losses of several million dollars which have and always will occur under Government management of our shipping.

How then can we reconcile or explain the fact that, while Congress directs the Shipping Board to have the primary object of developing a privately owned and operated merchant marine on the one hand, it at the same time entertains an amendment to the Independent Offices Appropriation Bill directing that no part of the money appropriated in the bill shall be used for the repair or reconditioning of any vessel unless reasonable opportunity has been given to Government navy yards to submit estimates on the work?

Does it not show when such a man as Senator Lodge, who is referred to as the scholar of the Senate, seeks political advantage in such a matter as his recent attempt to secure legislation that would have compelled the Shipping Board to send the *Leviathan* to the Boston navy yard that eternal vigilance and prompt action by both individuals and associations working for the good of the merchant marine are necessary?

If the Government is to engage in repair work, why not the municipality? New York city, for instance, is contemplating the construction of a huge dry dock while the concerns in this port who have spent large sums of money to give the Government and private owners the facilities

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they require are operating their plants only about half time. With competition as keen as it is at the present time in the ship repair business, it is obvious that any work of this nature allotted to public institutions on an estimate that is lower than the bids of private concerns will cause deficits that the taxpayer will be called upon to make good. If sectional politics is strong enough to defeat the will of the people as expressed in the Jones Act to get the Government out of the shipping business, then it is high time that the public should be informed of the matter so that they may again express their opinion on this subject at the next election.

Financing Foreign Trade

THE outstanding unsolved problem today is the financing of foreign trade. The Shipping Bill if enacted into law will enable American ships to compete with foreign vessels for available cargoes and it will also create a strong inducement for the exporter and importer to ship their goods in American bottoms. It will not, however, solve the question of how European countries are going to pay us for our exports. We do not want any more gold, for every ounce of it that we take weakens the exchange ratios and delays, so much longer, the time that foreign currencies may be reestablished on a gold basis. Our immigration law has reduced the inflow of foreign labor to a minimum that would sell its services and return the major portion of the money it earns to its home country. Our own unemployment problem makes this restriction a necessity although we are not unmindful of the debt that we owe to immigrant labor for the aid that it has given us in developing our vast industries. Nor can we permit the unrestricted dumping of foreign products that would close our factories and deprive our own labor of employment.

There remains, then, the importation of such goods or raw materials as are not obtainable in this country, the importation of such things as we do not raise or produce in sufficient quantity for our consumption and the importation of goods for re-export. However, it is not probable that these three factors could be developed sufficiently in time without liberal extensions of foreign credit to relieve underproduction here or abroad.

Although Europe financed us until we were able to stand upon our own feet, it is not so much a question of returning the obligation as it is a question of preventing a lowering of our standard of living. We have got to the point where we must either curtail production or export our surplus. We can export this surplus in ever increasing quantities and in direct ratio to the improvement of the standards in other countries. Unfortunately other Oriental countries are not as progressive as Japan, who has bought enormous quantities of goods in the world markets during the last fifty years, or our problems and Europe's problems of a surplus market would be quickly solved.

Much of the world remains undeveloped but it will not remain so. If Europe is aided in getting on her feet so that she can take her place in the march of progress, there will be no question of her ability to repay her debts but otherwise she will remain a constant menace to the whole world. The ninth National Foreign Trade Convention will meet in Philadelphia May 10, 11 and 12, when the ablest business minds of the country will concentrate on these problems. Let us hope that they will find a way to put our idle manufacturing plants, our idle ships and our unemployed to work.

Situations Wanted

ONE of the most distressing results of the present shipbuilding depression is the number of competent men skilled in all branches of this industry who are unable to find work. Not a week passes that we do not receive requests from men, many of whom we know possess more than the average ability in their particular line, to find them some opening for occupation in the business to which their lives have been devoted.

We know of no better way to assist these men in placing their qualifications before the eyes of the shipbuilding executives than through the *Positions Wanted* columns of our magazine. Marine Engineering and Shipping Age has made a special rate of 5 cents a word for such advertisements (minimum charge $1 for each insertion). This rate is far below that charged for other advertising and we have made it so in order that the man out of work can send over 5,000 messages and cover the entire shipbuilding field for the price of a luncheon.

The Hague Rules

THE National Foreign Trade Council has issued an appeal to the ocean carriers to put the Hague Rules into effect. The International Chamber of Commerce through its executive committee has approved the Hague Rules and directed that immediate steps be taken by its officers to secure the acceptance of these rules in the more than 20 countries holding membership in the International Chamber.

Although at least 20 of the most prominent British steamship lines operating between Great Britain, the United States and Canada have developed the provisions of these rules in their bills of lading for westbound traffic, they are precluded from doing this on the eastbound traffic by certain provisions of the Harter Act, which is the controlling legislation on this matter in the United States.

The Shipping Board has indicated to the Interstate Commerce Commission in connection with the consideration that that body has been giving to a through export bill of lading, that it intends to promulgate a port bill of lading in the near future, and the board has expressed the opinion that there should be no variance in essential particulars between the two bills.

As Section 19 of the Jones Act authorizes the board to only make rules and regulations affecting shipping in the foreign trade that are not in conflict with existing law, it would appear that Congress will have to pass enabling legislation which will meet the situation quicker than would a general revision of the Harter Act. It is essential and for the general interest of the country to secure as early a determination on these matters as is possible.

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Now For Action!

By "Old Scotch"

President Harding has very tersely expressed the opinion that all patriotic citizens, regardless of political affiliations, should have one end in view, and that is the development of an adequate American merchant marine. Congress now has before it the Government's plan for accomplishing this end. This plan has been endorsed by practically all leading shippers, shipowners and shipbuilders. It is up to you, Mr. Reader, to tell your Congressman to give it his unqualified support.

THE President has at last spoken the long expected endorsement of the principle of Government aid to our merchant marine. He has courageously carried out his pre-election promises to leave no stone unturned to provide for our permanency on the seas.

Rumors of opposition in his own party, of the probable antagonism of the so-called "agricultural bloc," of the opening evidences of inspired propaganda from foreign sources, have not deterred him an iota from his firm resolve. He had all phases of the intricate problem of American shipping thoroughly investigated by competent committees under the auspices of the Shipping Board, and, after carefully weighing in his own mind the various pros and cons of the problem presented, he has delivered to Congress a message based on sound and logical principles and facts.

The message and supporting evidence have been thoroughly considered, and, to those who propose to combat the array of facts presented, the gratuitous advice is given to watch their steps. No proposed legislation of similar import has ever before been given the careful, scrutinizing and painstaking thought which has attended the formation of the measure now pending before Congress.

Well Begun Is Half Done

The old saying that "Well begun is half done" should apply with full force to this measure. All possible points of attack have been carefully guarded against, but none of us must forget that the unexpected very often happens, and it is the other half of the completion of the enactment of this proposed law to which all of us who are interested in the American merchant marine, must bend every effort.

Opposition is bound to arise and, in fact, is already in evidence. It behooves every one interested, and I take it that 99 percent of the readers of this magazine belong to this category, should bend every effort to lend aid to this meritorious bill. If false representations of the intent and purpose of the bill crop out in the daily papers, or in your daily conversations with people ignorant of shipping, leave no stone unturned to correct the wrong impressions which may start in those ways. Write your Congressman and Senators of your interest in the measure and give them supporting evidence of the benefit it will be to their own districts and to the country at large. The time is now here when every proponent of American shipping must show his hand and lend every assistance possible.

This is the last call, and if it fails, your jobs in shipyards, on board ships, or in the various ramifications of business connected with our shipping, will fail also. If you are out of a job now, and unfortunately many people connected with shipping are in that unfortunate predicament at this moment, here is the last chance to start up business again and get back into harness.

Most people go into the shipbuilding or ship operating game because they love it. If you are anxious to get back with your first love, you must do all you can individually and collectively to push this bill across. It will be over one way or the other in the next four months, as our Congressmen come up for re-election next fall, and in election years they don't like to linger around Washington much after July 1, as they have many fences which need mending around home from that time up till the first Tuesday in November.

Let Your Congressman Know Where You Stand

If you are out of a job now, tell your Congressman that if he can see his way clear to vote for this subsidy bill it will probably give you a chance to get another job, and, incidentally, when he is hunting around for support to retain his job in Washington, you might see your way clear to give him a boost on election day. The essence of practical politics is based on the old principle of "One good turn deserves another," so, if you want a Congressman to help you out when you are in trouble, don't forget to return the compliment when he is struggling to retain his job.

Knowing many of those gentlemen very well, I can vouch for the fact that there are no more appreciative men anywhere than the average Congressman. If you are interested in a pending measure and you write your representative telling him that you are, and the reasons why you are, he will hesitate a long while before turning you down. If you can convince him that he should vote for a certain bill, and he does vote for it, and you should write him a letter of thanks, it would be a case, as certain cartoonists describe it, of "Oh! Boy, how he do appreciate it."

It is so usual for the average citizen to condemn and speak evil of their representatives in Congress and other legislative assemblies, that a little praise and expression of appreciation now and then goes a long ways towards encouraging our chosen spokesmen on public questions. From the writer's many years of acquaintance with public men, he has drawn the conclusion that the great majority of them are honest and anxious to do the right thing. On subjects with which they are not familiar they are regular corkscrews for drawing out facts, and generally when good honest information is presented to them they vote the right way.

In the matter of this subsidy bill, we have all the facts and arguments on our side, and it is up to all of us to see that they are sown in the right field, which now is at the Capital in Washington.

If they want a good example of the benefit of a merchant marine, tell them the following incident, which fairly well illustrates the point.

One of the Many Benefits of a Merchant Marine

The good ship *George Washington*, by virtue of the recent scrap with the Kaiser, now belongs to the United States and flies the stars and stripes. A few weeks ago she started from New York with a party of American citizens on board, numbering about 650. We Americans, you know, love to travel around and visit sights about which we have read since childhood. Hence when it was advertised around the country that this American vessel would make a trip of ten

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weeks' duration, during the inclement winter and spring months, up the Mediterranean, visiting the Holy Lands, Egypt and other historical places, many of our citizens dug down into their saving accounts and "coughed up" an average of $1,650 each for the pleasurable experience. One enthusiast, it is stated, paid $16,000 for the privilege of sojourning in the so-called Presidential suite during the ten weeks' tour. Another, less wealthy, is said to have made an offer for the privilege of sleeping in the barber's chair during that period, when he was informed that all staterooms had been sold. A very easy calculation will show that over one million dollars were paid for this single trip, of which, it is estimated, there will accrue a clear profit of probably $100,000 to the Shipping Board.

Of course, it is not intended to convey the impression that all trips made by Shipping Board vessels are relatively as profitable. Far from it, sad to state! The great underlying principle of this illustrative trip is that the million dollars taken from our people's savings is kept at home, and spent mostly within our own borders. The officers and crew are American citizens and support families living in our midst; the vast quantities of food purchased were bought from our own farmers and merchants; our repair yards will benefit from the necessary voyage repairs after the vessel returns; the various electrical, deck and engine room supplies were purchased from American dealers, who, before, had purchased them from manufactories scattered all over our own land. Many similar excursions have sailed forth from our home ports to foreign lands, patronized exclusively by American citizens, but can you recollect of any such making the trip under the American flag before? I cannot.

What the Subsidy Bill Will Do

Suppose, for example, that there should not be any profit for a private shipowner for a trip similar to this, which is altogether probable, as this represents exceptionally favorable circumstances, as such a trip can only be made about once a year. In other words, a private shipowner might break about even on receipts and expenditures, and hence would not be warranted in undertaking the enterprise. The proposed subsidy bill, if passed, would return him approximately $25,000 based on speed, tonnage and distance traveled, or just about enough to turn the balance from failure to success. Will it not be a good investment for the Government by the paying of that small sum to keep the expenditure of over a million dollars in our own borders?

Why our dear old Uncle Sam would collect almost that amount in the various taxes he levies on the people interested in the expedition. In addition to that, he will have a ship of inestimable value to him in time of war, maintained in peace times at private expense. As a by-product, we must give credit to a large amount of self-satisfaction and innate pride on the part of American tourists in that they can visit foreign parts on vessels owned, manned and operated by our own people.

The principle of expending a small direct sum of money or of granting direct exemptions in taxes, etc., in order to secure the expenditure of much larger amounts in certain communities, is one that is well recognized and adopted throughout our land. Just call to mind while passing through many American towns, on the railroads, the numbers of signs you see to the effect that "Free Factory Sites" are offered to any one who will establish a business in that particular town or city. Some offer exemption from taxes for a long term of years and various other inducements.

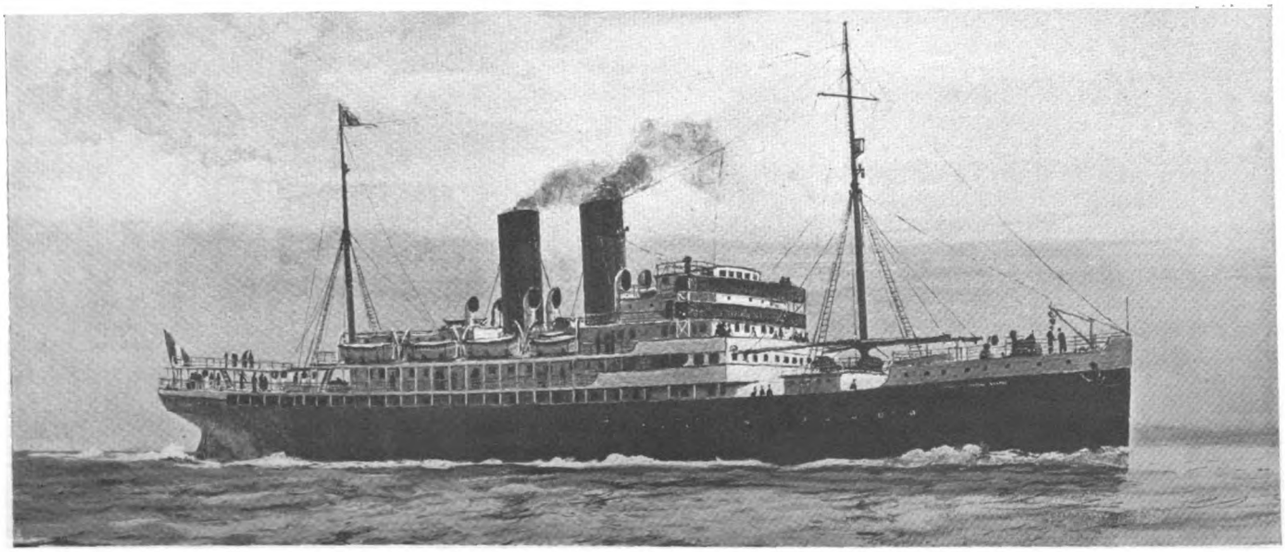
It is estimated that we spent over $500,000,000 for ocean transportation last year when business on the seas was very, very dull. We certainly are entitled to retain at least half that amount within our own borders, but we did not by any means. If we can expend directly the maximum amount of the subsidy recommended by the President, of only $32,000,000, and guarantee thereby the retention of at least $250,000,000 to spend among our own citizens, is it not from this standpoint alone a most excellent investment?

I have attempted in this series of articles to bring out the most salient points of advantage to be derived from having our own merchant marine, and I must admit that the surface only has been scratched.

President Harding has very tersely expressed the idea that all patriotic citizens, regardless of political affiliations, have one end in view and that is the permanency of an adequate American merchant marine. He also suggests that, if any one does not agree with the recommendations he has made to accomplish the object, it is up to the critic to suggest better methods of accomplishment.

I think we can all agree with the executive on that point.

We, in this instance, are all from Missouri and would like to be shown the better methods, if there are any.



Geared Turbine Steamer Gouverneur General Chanzy, Built by Messrs. Cammell Laird, of Birkenhead, for the Marine Merchande, for Service Between Marseilles and Algiers. The Vessel Maintained a Speed of 19.559 Knots on Her Four-Hour Full-Power Trial

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The Merchant Marine Bill of 1922 Analyzed

One of the Experts Who Assisted the Shipping Board in Framing the Bill Outlines Its Merits

By Winthrop L. Marvin*

IN form the bill "to amend and supplement the Merchant Marine Act, 1920, and for other purposes" (the new shipping bill, to be known as the Merchant Marine Act of 1922) brings varying emotions to those who study it. Maritime Europe is aghast; its "listening stations" in this country failed to predict the blow that was coming. The new bill reaches further and hits harder than our competitors by sea had imagined, but it does this without fracturing treaties or unduly provoking retaliation in kind. Suppose Great Britain, Germany and Italy reserve their emigration, as we propose to do our immigration, 50 percent to National vessels—what harm can come of that? It would be an entirely fair and reasonable arrangement all around.

Ship Sales

In the first place, it is significant that the new bill skilfully amends the ship sales section of the Jones Act of 1920 so that the Shipping Board will be freed of all restrictions as to cost of reproduction, etc., and it is directly authorized to dispose of the government-owned fleet at world-market prices. This will presumably have the support of most of the majority party in Congress, and the Democratic minority is faced with the ugly historical fact that in past years, urging a free ship policy or free purchase of vessels from abroad, it has contended that Americans should have a chance to buy their ships for foreign trade "on even terms with their competitors!" It must be remembered that the free ship provision of the Panama Canal Act of 1912 remains in force, and that American shipowners have a lawful right to buy foreign trade ships abroad, though these imported vessels, except in special cases, will not be eligible for subsidy. If any Democrats object to a "sacrifice" sale of government ships all the Republicans will have to do is to turn their own arguments against them.

Construction Loan Fund

A second important amendment of the Jones Act is provided in the new bill by the specific naming of the sum of $125,000,000 as a construction loan fund which may be availed of either for the building of vessels "of the best and most efficient type, equipped with the most modern, the most efficient and the most economical machinery and commercial appliances," or "in the equipment of vessels already built with machinery and commercial appliances of the type and kind mentioned." Under this provision it is anticipated that powerful aid will be given to the construction of fast liners in which we are so notably deficient, and to the construction or equipment of motorships. This is a fair interpretation of the purpose in the minds of the authors of the present measure. Very liberal are the limitations that "no loan shall be for a greater sum than two-thirds of the cost of the vessel to be constructed or of the value of the vessel when thus re-equipped, nor shall any loan be made at a rate of interest less than 2 percent per annum."

It is to be remembered that when the British government in 1903 loaned to the Cunard Company $13,000,000 to build the *Mauretania* and *Lusitania,* the rate of interest was 2¾ percent.

Another liberalizing amendment of undeniable value to shipowners is the change made in Section 23 of the Act of 1920, providing that for ten years for the purpose of ascertaining net income subject to the war profits and excess profits taxes of the Act of 1918, or any and all taxes on income of the Act of 1921 or any subsequent Act, the deduction of an amount equivalent to the net earnings of vessels in the foreign trade. It is stipulated that the amount of such deduction shall be pledged to the building of new ships in the United States, one-half of the cost of such ships to be paid for out of the ordinary funds or capital of the owner. The Jones Act required that two-thirds should be of new capital. A similar deduction is provided for owners that may sell vessels built prior to January 1, 1914, under Title I, II and III of the Revenue Act of 1921—this again on condition of new construction in American yards. Thus these features of the Jones Act are made distinctly more valuable.

Deduction for Shippers Using American Vessels

A wholly new feature of American maritime law is that provided for in Section 301 of the new shipping bill for a deduction from the amount which would otherwise constitute the income tax of a sum equivalent to 5 percent of ocean freight money paid for transportation of merchandise in American ships in the foreign trade. This is an ingenious new departure intended to serve the purpose of a part of the preferential duty of the original Jones Act—but, as a matter of fact, it is far more valuable and effective, for it would apply to all merchandise, dutiable or free, inward or outward.

This is treaty-proof. It is not a subsidy, but an indirect aid. Its potential importance is incalculable. It will appeal to all shippers small and large, and will have the effect of making all American vessels first-preferred bottoms. This is one thing which our foreign competitors have been sharply worrying about. They had not expected this new scheme and do not even yet know how to take it. It would apply to the benefit of the entire American merchant marine engaged in foreign trade—"tramps" as well as liners, in proportion to the freight moneys received, which, per actual cost of ship, are far greater in "tramps" than in liners. This may be regarded, therefore, as distinctively encouragement to the slower cargo ships and as a material addition to their modest subsidy.

Of great though not easily appraised value also is the provision of Section 302 allowing more equitable allowance for the extraordinary depreciation in vessel property since January 1, 1921. In Section 303 tonnage taxes on all ships, American and foreign, are doubled, but the revenue goes to the merchant marine fund for the benefit of American shipping.

Assures 50 Percent of Immigration for American Ships

It is to be assumed that the language of Section 401, the purpose of which is to reserve at least 50 percent of immigration to vessels of the United States, has been carefully studied by its authors. The language is technical, but the ways and means of enforcing this proposal must be somewhat complex. Fifty percent of the immigration year after year will go far to make at least 50 percent of the transatlantic passenger liners American, for the overwhelming American majority of cabin passengers will naturally seek

*Vice-president and general manager of the American Steamship Owners' Association, New York.

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American ships as soon as an adequate service is created. This is a bar to any growth beyond a certain point of the former huge German steamship concerns, and is apparently a barrier to any further growth on the part of the Cunard Line and its auxiliaries. But the provision is, after all, fundamentally a right one. The United States must have a sufficient naval reserve to maintain its naval standing under the limitation of naval armament. The greatest of these naval reserve steamers are to be sought on the transatlantic routes.

Provides for Naval Reserve

Moreover, these naval reserve ships must be fitly officered and manned in an emergency. This gives a vital value to Section 501 of the new bill, with its assurance of a merchant marine and naval reserve of picked officers and seamen of our merchant service who, after the British example, will receive retainers from the Government. Great Britain before the war had more than 30,000 enrolled in her merchant reserve. We must have an equal number, for we will have equal need. Of course the foreign agitators of the "International" Seamen's Union will fight it—but the time is not now when these gentry can hope to veto the possession of a naval reserve by the United States. President Harding on his own initiative decided months ago to turn the army and navy transport service over to the American merchant marine. Section 601 of the new bill arms him with power to do this of which he is already possessed. However, this is an essential part of any constructive National maritime policy, regardless of other provisions.

The Subsidy

Under the accurate heading "Compensation" rather than "Subsidy," Section 701 provides for carefully graduated mileage payments to "every sail or power-driven vessel of 1,500 gross tons or more, documented under the laws of the United States and operated in foreign trade." Inclusion of good sail craft is justified, for they are performing a useful service, though their numbers will not further increase. A basic rate of compensation is one-half of one cent for each gross ton for each 100 nautical miles traveled—this applying to all ships capable of a speed on light draft up to 13 knots—that is to say, this covers the great bulk or almost all of the cargo-carrying ocean tonnage of the United States. At 13 knots the increase for speed begins with a rate of two-tenths of one cent for each gross ton per 100 miles traveled—and so on step by step up to a rate of two and six-tenths cents for great liners driving at a speed of 23 knots or over.

This compensation, payable on both outward and homeward voyages, is a higher amount than has been hitherto proposed for liners, but, on the other hand, these ships must carry the mails without pay. Under the circumstances, therefore, this compensation, save for exceptionally large, high-speed ships, can be regarded as only moderate.

It may even fall short in the case of some indispensable services, as to South America and the Orient, for example. But in such cases a further provision of the bill in the final paragraph of Section 702 authorizes the Shipping Board to increase the compensation as may be necessary to secure the maintenance of indispensable services, the increased compensation, however, not to exceed twice the regular rate. Moreover, the Shipping Board is authorized to reduce any compensation found excessive.

These elastic features of the compensation portion of the bill, together with the limitation on profits in one of the paragraphs of Section 703, are unique in American shipping legislation. A State-aided ship may not realize a net operating profit of more than 10 percent. This is a legislative experiment that may prove unwise in its result, though it will undoubtedly facilitate the passage of the bill by Congress. Mid-Western Senators and Representatives are frankly recognizing this new bill as "something different," and as satisfying their scruples against excessive subsidies. However reluctant the seacoast States may be to recognize this statutory limitation, it may perhaps prove to be the winning of the law.

The Merchant Marine Fund

Into the merchant marine fund must go 10 percent of the customs receipts, and the increased tonnage taxes, together about $34,000,000 annually—and also the compensation which under the 10 percent limitation may have to be paid back. A very important clause is Section 702 authorizing the Shipping Board to conclude a ten-year contract with shipowners, on behalf of the United States. Therefore, the bill, if once enacted, cannot be easily set aside.

Under one of the provisions of Section 701 oil tank carriers and like craft owned by great producing companies are required to hold open until ten days before sailing "substantially one-third" of their cargo capacity for use as a common carrier, in order to be eligible to the compensation provided. Here again is a provision manifestly inserted to smooth the passage of the bill to meet objections certain to be raised by a certain class of lawmakers. This is another novel feature of the bill which cannot easily be analyzed until it is actually working in practice. It is good expert opinion, however, that the tank and other ships need not be embarrassed, if the provision is enforced in a reasonable spirit.

Philippine trade receives exceptional favors in the bill, anticipating the application of the coastwise laws as ordered in the Act of 1920. The new bill nevertheless stipulates that "trade between the United States and the Philippine Islands * * * shall be considered foreign trade, whether covered by the coastwise laws or not." This would permit the granting of the compensation of the new bill to American ships in the Philippine trade, though their trade was technically coastwise. It is manifestly the purpose of the Administration to make sure that our Philippine commerce is guaranteed most favorable treatment, because of the distance that lies between the islands and the American mainland. Under the shelter of the coastwise law, and with subsidies besides, there can be no shadow of a doubt that our Philippine carrying trade will henceforth be notably efficient and prosperous.

Altogether the proposed Merchant Marine Act of 1922 does more for the American merchant marine than any like measure ever contemplated. Defects of detail it may have—these can be corrected. But the bill itself, if enacted in substance, will prove a Magna Charta of the ocean shipping trade of the United States.

The indirect aids of the bill are very powerful, but by themselves they are not sufficient. The direct compensation to liners and to cargo craft is absolutely indispensable to the complete success of this significant measure. Without that compensation the competition of low-wage and often subsidized and bountied foreign flag ships cannot be successfully met. Congress must accept the bill as a whole, in order to deal justly and effectively with the long-disputed but still unsolved problem of American shipping in the overseas trade.

Shipping Board Dry Docks for Sale.—Announcement is made that the contracts with pioneer purchasers of Shipping Board dry docks have been canceled. Contracts, or the docks themselves, will soon be advertised for sale to the original holders of the contracts. These docks cost an average of $900,000 each, but will not bring more than $350,000 today, it was estimated. All are 10,000-ton docks on the Atlantic and Gulf coasts, some of them being at Baltimore, Norfolk, New Orleans, New York, Perth Amboy, Mobile, Galveston, Jacksonville and Weehawken.

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Early Hearings on Shipping Bill Promised

Democrats Urged to Be Non-Partisan—Independent Offices' Appropriation Bill Reported to House—Shipping Board Reduces Expenses

By Harold F. Lane

LEGISLATIVE consideration of the administration's plan for extending direct and indirect aids to American shipping is about to begin in earnest. Hearings on the merchant marine bill before the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries, sitting jointly, are expected to begin before this issue of MARINE ENGINEERING AND SHIPPING AGE reaches its readers. Commissioners of the Shipping Board, who have unanimously approved the plan recommended in the President's message of February 28, are to appear as witnesses, as will many of the members of the committee of experts who assisted the board in its preliminary study on which the plan was based. Representatives of the shipping and other industries also are to be heard.

It is announced that the hearings will begin on March 28. It is the hope of members of the committee that they can be concluded in about three weeks' time although adjournments from time to time may spread them over a longer period. It is expected that Chairman Lasker will be the first witness. Copies of the bill have been submitted to the chairmen of other committees who have jurisdiction over some of the various subjects included in the bill, such as the ways and means committee, committee on naval affairs, the immigration committee and the committee on interstate and foreign commerce.

The Democratic members of the Shipping Board, George E. Chamberlain, Frederick I. Thompson and W. S. Benson, on March 6 addressed a letter to the members of the two committees, emphasizing the fact that the recommendations of the board to the President were based upon an intimate study made by the board, without political considerations, and urging the Democratic Congressmen to treat the subject in a non-partisan manner, withholding judgment until after full hearing. The letter said that the members of the board were governed solely by the real questions involved, as follows:

"1. The necessity for maintaining a merchant marine, developed from the immense fleet called into existence by the emergencies of war.

"2. The necessary action to be taken to assure to the United States its former position and prestige on the high seas.

"Aside from the economic necessity for the establishment of an adequate merchant marine under the American flag, deep consideration was given to that aspect embodied in the merchant marine act, 1920, providing for the merchant fleet to be a naval auxiliary in time of war. It is our opinion there can be no divergence of opinion as to the necessity for the full establishment of an American merchant marine; the only question upon which there could be divergence of opinion is whether aid, either direct or indirect, or both, should be granted to accomplish that purpose. It is our opinion that the establishment of an American merchant marine will be impossible without such aid as will equalize present differentials that exist in favor of foreign shipping, and our recommendation to the President contemplated direct aid only in the event the indirect aids first suggested were inadequate to properly develop and maintain an American merchant marine, the direct aid itself being nonexistent if the indirect aid sufficed, and further limited as to profit to the ship only up to an adequate return to the operator on his investment. This assures no profiteering and brings into being direct aid only when it becomes a final essential to maintain American-flag ships on the high seas.

"We understand that there will be a joint hearing of the appropriate Senate and House committees on the bill in question, and we trust you will not deem it impertinent in us, the Democratic members of the United States Shipping Board, to suggest to you and the other Democratic members of the committees of the Senate and House to withhold a final judgment with respect to this legislation until after the hearings have been completed and full opportunity given to the members of the board to state the reasons guiding their action in unanimously recommending direct and indirect aid to American shipping, and so that the full details of the proposal submitted, which has taken many weeks of survey and consideration, shall have been placed, in all detail, clearly before you."

The joint legislative conference of the American Federation of Labor went on record at a meeting in Washington on March 10 as opposed in principle to the provisions of the administration bill and in particular to the sections providing for a merchant marine naval reserve and dealing with the question of immigration, which the committee viewed as nullifying provisions of the seamen's act.

APPROPRIATION BILL REPORTED TO HOUSE

The independent offices appropriation bill, carrying the appropriation for the Shipping Board and the Emergency Fleet Corporation, was reported to the House on March 15 and after considerable discussion the House voted to insist on its disagreement with the amendments inserted in the bill in the Senate regarding the continued use of the $55,000,000 and as to the number of salaries in excess of $11,000. During the course of the debate, Representative Byrns of Tennessee stated that Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Company, has a position at a salary of $11,000 a year as a member of the claims commission of the Shipping Board, while his company has received a large contract from the board. A statement was later issued by the board stating that Mr. Ferguson was selected by the President to serve as a member of the claims commission without salary, but that he has at no time sat with the commission and has taken no part in its work on account of his connection with the Newport News company, which company has claims against the Emergency Fleet Corporation, until all the claims in which his company may be interested have been finally concluded.

The conferees submitted a report on March 9 which showed that they had not yet reached a complete agreement on the conflicting provisions of the House and Senate bills, and were given instructions to continue the conference. They had agreed to insert the language proposed by the Senate, providing that no part of the moneys appropriated or made available shall be used for the repair or reconditioning of any vessel until a reasonable opportunity has been given to the available Government navy yards to estimate upon the cost of such work, modified so as to permit the Government arsenals to bid on such work, and further modified so as to require estimates from the navy yards or arsenals when the expenses of such repair or reconditioning is in excess of $100,000, instead of

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$5,000, as proposed by the Senate. They had also agreed to strike out, as proposed by the Senate, the provision that no part of the sums appropriated shall be used to pay a greater sum than 5 percent as commissions for the placing of advertising matter contracted for; and the matter, inserted by the Senate, modifying the limitation placed by the House upon the appropriation for the payment of claims by the Shipping Board or Emergency Fleet Corporation; also, as proposed by the Senate, the prohibition of the use of Shipping Board or Fleet Corporation funds for the printing of "bulletins."

Shipping Board Reduces Expenses

On the eve of his retirement from active service as president of the Emergency Fleet Corporation on March 4, Joseph W. Powell issued a statement announcing that the Shipping Board had liquidated $20,373,000 of its assets and had reduced its personnel by 3,302, saving $5,290,000 on payrolls, including $1,324,000 on caretakers. Its operating costs have been reduced by $900,000 a month and the insurance, repair, voyage and lay-up costs as well as general administrative expenses have also been reduced in the last six months.

Detailing the progress made in liquidation since his assumption of office last August, Mr. Powell said that on laid-up ships, which had increased from 950 to 1,278, a saving of $1,324,000 had been made; ships had been sold for $5,000,000, houses for $6,073,000, surplus materials for $5,000,000, and securities and mortgages for $4,300,000, a total of over $20,000,000.

Voyage expenses were reduced from $1,896,000 in July, 1921, to $934,000 in January, 1922. Repairs and betterments, costing $1,467,000 last July, cost only $950,000 in January, even though 30 ships were broken out and repaired for the Russian grain. Insurance on ships, Mr. Powell said, had dropped from $578,000 in July to $416,000 in January, while expenses for lay-up fell off $139,000 during the six months. Administrative expenditures during the past month had dropped from $906,000 to $678,000, he said. Total expenses in December were $4,137,000 and for January were $3,445,000.

For February it had been reported that, whereas the Shipping Board paid its operators $6,400,000, a return of $6,500,000 had been received indicating a cash income of over $100,000 for the month, whereas a deficit has been the case heretofore.

Newspaper publication of this statement, however, made it necessary for Mr. Powell to explain, in a letter to Representative Wood of the House appropriations committee, that the statement did not mean that the Fleet Corporation was making a profit and had no relation to the operating showing for the month, but merely referred to the manner in which it was husbanding its cash and keeping careful check on the outlays by operators.

Mr. Powell's Explanation

"As a matter of fact, as both Mr. Lasker and I repeatedly testified before your Appropriations Subcommittee," Mr. Powell said, "the Shipping Board is losing between $3,000,000 and $4,000,000 per month. Regardless of bettering conditions which now exist in freights, the loss of the Shipping Board for some time to come will continue constant at the approximate $4,000,000 figure, because vast sums are being paid out at the present time for insurance due from the past, of which we knew nothing until within the last two weeks. Yesterday Mr. Lasker paid out $2,000,000 for P. & I. insurance due from prior periods to the present board's incumbency, of which no record existed and of which no knowledge came to the board until two weeks ago. Also, during the period between August and January, when freights were scarce and rates soft, very little work was done on the tied-up fleet, because Mr. Lasker desired to husband the cash resources of the Shipping Board so as to come within the limitations of appropriations. It is for that reason that the expenditures on the tied-up fleet, referred to in the article attached, were so low, operating as we were a lesser number of ships than we had been, and having taken out at first the best ships.

"From now on there will be comparatively large expense in repairs in further ships we take out of tie-up and in putting necessary reconditioning into some of the tied-up ships. All this was deferred during the period when voyage losses were so great; but, now that conditions are better and voyage losses will be lessened, repairs to the tied-up fleet can no longer be deferred. For this reason the loss will be constant at around $4,000,000 a month, as testified to by Mr. Lasker and myself. In other words, during those periods when voyage losses are great, we cannot do necessary repairs to the tied-up fleet. Whenever we get relief from voyage losses, the tied-up fleet is repaired. So that according to this policy of Mr. Lasker's, the Fleet Corporation will keep within appropriations, keep trade routes going, and keep its tied-up fleet in condition.

"Permit me further to call to your attention that while it is true, as the article states, that we have liquidated some $20,000,000 worth of assets since the new board came into office, only $7,045,490 has been collected on same, of which $1,500,000 came in last week. The balance of the moneys on liquidated items are due, either in part before July first next or extend over long periods. A careful estimate made yesterday, which was submitted to me last night, would indicate that the amount that we can surely count upon to be realized in cash from liquidation between now and July first will be approximately $25,000,000, as stated in our testimony before your committee. There is a vast difference between cash received from liquidation before July first and amount of goods liquidated, which are sold for part cash and part on long time."

Mr. Powell, in resigning his office, in which he was serving without salary, agreed to undertake one commission for the board, a survey of the 30 former German ships, most of which are docked at Philadelphia, to determine which appear advisable for the board to recondition with a view to offering them for sale.

Commission Modifies Export Bill of Lading

The Interstate Commerce Commission has issued an order modifying in certain particulars conditions in its export bill of lading upon recommendations made by the United States Shipping Board, after a hearing at which the board was represented by counsel and Vice-President W. J. Love of the Emergency Fleet Corporation. The board has approved the bill of lading as thus amended and agrees that it should not be put into effect until July 15. The board also approved the bill of lading prescribed by the former order of the commission, to be used until that date.

The Interstate Commerce Commission has also issued an order in accordance with Section 441 of the Transportation Act designating points on railroads at which information relative to the handling of export shipments by common carriers by water in foreign commerce shall be maintained and at which through bills of lading to foreign destinations in connection with ocean carriers, whose vessels are registered under the laws of the United States to points in non-adjacent foreign countries, shall be issued.

Increased Cargo Offerings.—J. Barstow Smull, vice-president of the Emergency Fleet Corporation, is receiving many inquiries from M. O. 4 operators at Gulf and Atlantic ports for more ships, showing an increase in cargo offerings. It is the policy of the Shipping Board not to furnish ships, however, unless the operators can demonstrate that they will be able to show a profit or at least earn expenses.

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Shipping and Shipbuilding in Great Britain

England Sees Danger in Portugal's Example of Flag Discrimination—Abolition of Income Tax for Shipping Advocated

By W. H. Wendon

THE most widely discussed subject in shipping circles at the present time is in regard to what at first blush is a question of minor importance. I refer to the Portuguese Government's decree which imposes in several different ways a most severe handicap on the ships of foreign nations calling at Portuguese ports. The comparative unimportance of the trade of any country with Portugal would, of course, be sufficient in ordinary circumstances to render the decree beneath the notice of the major maritime nations. But the shipping community in this country is fearful that the bad example which Portugal has thought fit to set is fraught with serious consequences. Indeed, if the project is not nipped in the bud, it is regarded as inevitable that other nations will follow suit and that the principal maritime countries of the world will be at each other's throats on the question of flag discrimination.

Sir Kenneth Anderson, the head of the Orient Line, to quote only one shipping authority, maintains that it is imperative that British shipowners should, with all possible emphasis register their protest at the action of Portugal and reaffirm the conviction of owners here that, not only in the interests of British shipowners but in the interests of all shipowners and in the interests of the whole world-wide community, irrespective of nationality, trade or profession, such a policy must prove ultimately injurious.

Discrimination an Obstacle to Exchange

The effects of discrimination are obviously manifold. It is an obstacle to exchange and automatically increases the cost and the scarcity of commodities and services. In short, as Sir Kenneth Anderson stated recently at the annual conference of the Chamber of Shipping of the United Kingdom, discrimination invites the world to a game of "Beggar my neighbor," in which all must lose and none can gain. A disturbing feature of Portugal's action is the belief that she has been inspired to adopt her new policy at the direct or indirect persuasion of Germany.

A representative body of shipowners in London has unanimously resolved to urge the British Government to direct the attention of foreign governments who have recently adopted or threatened measures of flag discrimination to the prejudicial reaction of such measures on the trade of the world and to the unreasonableness of expecting a continuance of the free navigation and equal trading rights hitherto accorded by the British Empire in the face of measures hurtful to its shipping.

Levying of Income Tax on Shipping of Other Countries

Another subject of the greatest importance to shipowners in all countries is the levying of taxation abroad. Shipowners in Great Britain advocate the abolition of international income tax, by which expression is meant each country levying income tax on the shipping of every other country. Each country necessarily differs in its system of taxation, so that a ship proceeding from, say, Antwerp to the River Plate might have seven different countries to placate, seven bundles of forms to fill in, accompanied by seven different penalties.

Then there is the fallacy lying in the assumption that by calling at a port the owner of the ship is making a profit out of that country in which the port is situated. Whereas, in fact, the owner is spending money all the time his boat is in port. Fiscal taxes should, therefore, it is urged, be payable only to the country to which the ship belongs.

America Takes Initial Step

The greatest praise is due to America for having taken the initial step in the abolition of these taxes. In her Revenue Act of 1921, passed in November last, Congress exempted from tax the income of a foreign shipowner, provided an equivalent exemption is granted to the citizens of the United States. British shipowners have pronounced in favor of petitioning the Government to seize the opportunity afforded by America and of putting an end to this international taxation conflict. The slogan of British shipowners is: "The profits of shipping are earned on the high seas and as such are taxable only in the country of domicile."

Port and Harbor Dues

A vigorous campaign is being conducted in Great Britain to secure a substantial reduction in port and harbor dues. The Chamber of Shipping has expressed its views with no uncertain voice and it has the backing of the principal industrial associations in the British Isles. Thus, the Federation of British Industries, a young but decidedly go-ahead body, has communicated its opinions to the port authorities of London, Liverpool, Manchester, Hull and Dundee. It points to the fact that, when a survey is made of the charges prevailing at the different ports and docks, it is found that only one or two of these have charges standing at less than 100 percent above the pre-war level, while, in the great majority of cases, the charges range from 100 to 150 percent above 1914 and in some instances even exceed this figure.

The contention of traders is that the port and harbor charges are not only quite out of relation to the general level of prices prevailing in this country, but that they give no adequate reflection of the direct advantages which have accrued to the dock companies through the fall in the price of the material which they consume. There is, therefore, the grave danger of shipowners being still further handicapped in their efforts to reduce freights to meet the demands of British manufacturers and exporters, and the consequent diversion of traffic from the United Kingdom to Continental ports, where charges are on an appreciably lower scale.

The Federation of British Industries hopes, as a result of its protest, to obtain a reduction in port and harbor charges of at least fifty percent. They will, however, not attain their object without a struggle. The dock and harbor proprietors, for their part, are convinced that their charges are no higher than are justified, Lord Devonport, the chairman of the Port of London Authority, declaring that, if the authorities were to reduce their charges in the manner proposed, they would be heading straight for the bankruptcy court.

"Survival of Fittest" Still Continues in Shipping

In the United Kingdom shipowning world in general, and Cardiff in particular, the survival of the fittest continues. Another late boom single ship concern—the Glynn Shipping Company, of Cardiff—has met with disaster, the mortgagors having exercised their rights by taking possession of the company's 5,200-ton deadweight steamer. The company has

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other liabilities to the tune of £27,500, of which £23,000 is due to the tax authorities and £4,000 to bankers. The profits secured during the company's first year's trading ending August 31, 1920, were £33,575, of which £15,000 was reserved for taxation and depreciation, and a dividend of 12½ percent paid. As a result of the second year's working a profit of £18,239 accrued, and a dividend of 2½ percent was distributed. The affairs of this company are typical of so many other concerns formed during the period of inflated ship values.

Reduction in Ship Repair Costs Urged

Shipowners are counselling the urgency of securing a reduction in costs in another direction, namely, ship repairs, which are still costing this country far more than in pre-war days and are appreciably higher than in some Continental countries. Sir Frederick Lewis, the newly-elected president of the Chamber of Shipping, thinks it may safely be said that many vessels are now lying unrepaired because the cost of repairs would exceed the value of the ships when repaired.

Tonnage Laid Up

An estimate of the British tonnage at present laid up in the United Kingdom puts the figure at 2,250,000 tons gross, while the United States Shipping Board (apart from privately owned vessels, wooden and composite vessels) is stated to have some 1,000 ships lying idle, representing possibly something over 4,000,000 tons gross, other maritime countries, of course, being in much the same unfortunate position. Incidentally, there are 30,000 British merchant marine officers and seamen without employment at the present time. Sir Frederick Lewis put the shipping depression question in a nutshell when he confessed that he had no sovereign remedy for it. He recalled that schemes for proportionate laying up of tonnage, for breaking up, or even sinking, old and obsolete tonnage have all been canvassed, but that these schemes, excellent in their way, all start with the idea of cutting down the supply to meet the demand, whereas the aim should be to increase the demand up to and beyond the supply. He considers that the best part shipowners can play is in reducing operating costs to a minimum and raising the efficiency of cargo handling in ports to a maximum.

German Shipyards Busy

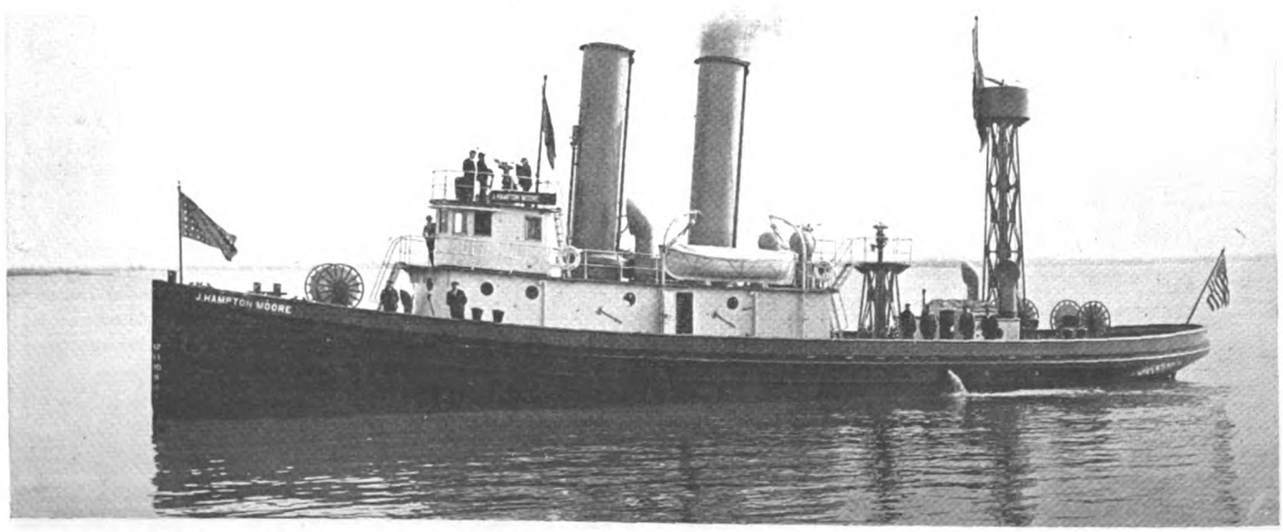
An absurdity of the tonnage position is that, despite the huge excess of cargo space in vessels, judged by the present lack of freight offering, coupled with the fact that it costs more to build new vessels—even in Germany—than they can be bought for second-hand, German shipyards are still turning out a large volume of new tonnage, a great deal of the expenditure on material and labor thereby involved being pure waste.

Shipbuilding Faces Labor Crisis

The shipbuilding and engineering industries of Great Britain are in much the same dull position as of late. Indeed, in regard to engineering, something like a crisis prevails on the much-debated question of the rights of trade unions to decide when members of their organizations shall or shall not work overtime. The view of employers is that no trade union should be in a position to interfere with the right of employers to exercise managerial functions in their establishments, while employers for their part shall not interfere with the proper functions of the trade union. The subject has caused serious controversy in the past and it is generally hoped that engineering employers will make a great effort to secure once and for all a definite understanding with the unions on this point.

King George Interested in Navagation Congress

The King has consented to become patron of the Congress to be held in London, under the auspices of the International Association of Navigation Congresses, in 1923. Lord Desborough will be president of the Congress, which will be attended by the leading representatives of dock, harbor, shipping and inland navigation authorities of the chief countries of the world.



Philadelphia Fireboat J. Hampton Moore, Recently Built by the Merchant Shipbuilding Corporation, Chester, Pa.

The vessel is 120 feet 9 inches long over all, 28 feet beam, 12 feet 9 inches depth and on a draft of 9 feet has a speed of 14 miles per hour. Her equipment consists of four turbine fire pumps, one main water tower 30 feet above the main deck and two small towers 15 feet above the main deck. On top of each deck and on top of the pilot house there is a 3000-gallon monitor nozzle designed to operate at a working pressure of 250 pounds. The four pumps are capable of throwing 10,000 gallons of water per minute against a head of 200 pounds.

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Developments in Marine Insurance

Rating Shipping Board Vessels—Seaworthiness—Safety Rates—New Lake Carrier Type—Ice-Closed Ports

By "Bordereaux"

CLASSIFYING Shipping Board vessels for purposes of equitable rating is one of the most conspicuous problems now engaging marine underwriting attention. And it has to be confessed that in spite of the experiments constantly made during the last year or more it still remains a problem. To date, neither the insurers nor the insured have been satisfied with the results. This, upon reflection, will be seen to be unremarkable, because the Shipping Board's insurance problem is an extremely delicate one. Friends of the Board believe that Shipping Board vessels should be rated on the same basis as the old experienced liners; but the underwriters can not see it that way, in view of the lack of any extended experience back of the former's boats upon which the underwriters can safely construct conditions and rates closely approximating those regularly given the older lines. Even to approach the preferential or parallel basis desired by the champions of the Shipping Board boats there would have to be devoted to the problem close study by the ablest men in the insurance business in America.

And that is precisely what is going to be done now. A week or two ago Vice-President W. J. Love, of the Shipping Board, met in New York with a number of prominent marine underwriters who handle the bulk of the ocean cargo coverage of this market and consulted with them upon the best means for attaining the end so much desired by both sides of this controversy. The result was the holding of a meeting the following morning at the offices of the American Marine Insurance Syndicates at which practically every leading New York marine underwriter was present. A committee was appointed to grapple with this problem, consisting of the following eminent underwriters: Hendon Chubb, William H. McGee, Louis F. Burke, E. W. S. Morren, W. L. H. Simpson, J. E. Hoffman, F. H. Cauty, G. C. Moore, G. Brenker, C. R. Ebert, Samuel Bird, W. J. Roberts, S. D. McComb, C. A. Orr, D. F. Cox, A. F. Post, Jesse Spier, W. W. Parsons, George C. Owens and Charles R. Page, chairman. This group is representative not only of the leading American companies but of the foremost admitted foreign institutions as well. The committee, in turn, chose William H. McGee, Hendon Chubb and Charles R. Page as its conferees to confer with a similar group to be appointed by the Shipping Board.

The purpose of the appointment of this committee is to investigate carefully and impartially the conditions under which lines operated by the Shipping Board in competition with either American or foreign-owned private lines are operated and to recommend to underwriters generally the adoption of classifications which will tend to sweep away any differentials which may no longer be justified.

It is the general feeling of the underwriting community that Shipping Board vessels when operated in competition with privately-owned vessels are entitled to the utmost consideration at their hands and, whenever and wherever conditions will permit, the underwriters aim to put such vessels on a rating parity with other similar tonnage with which they may be in competition.

As it is well-recognized that the Government-owned vessels can seek only to be placed upon a parity of rating with their privately-owned competitors, it is hoped that as a result of the careful investigation of the facts which is being immediately undertaken, the committee may be able to recommend to underwriters the adoption of a classification basis which will give due recognition to the much improved conditions under which the Government-owned vessels are now operated.

As soon as the committee has been provided by the Shipping Board with the information essential to the prosecution of its investigations the former will proceed through the medium of several smaller committees to a careful investigation of the type and character of the vessels, both privately-owned and Shipping Board owned, engaged in various trades, and also to enquire carefully into the experience of the various managements. Upon the result of these investigations will depend the recommendations of the committee.

Marine Syndicates Annual Meeting

THE annual meeting of the American Marine Insurance Syndicates and of the United States Salvage Association was held on March 9. The fact that this was the first meeting at which the results of a full year could be presented, in view of the brief period in which the Syndicates have been operating, made the occasion one of more than usual interest. Enough was shown to abundantly establish the financial success of these important adjuncts to American hull underwriting. The latest figures, which were as of December 15 last, indicate that Syndicate "B" had at that time a credit of $520,000, and Syndicate "C" a credit of $1,627,000. By "credit" is meant a near approximation to profit; the precise profit can not be definitely given until the full period of the accounts has been run through. What used to be known as Syndicate "A" is now the United States Salvage Association, and this has only been in operation a matter of less than six months. W. W. Parsons, E. C. Jameson, F. H. Cauty and Lawrence J. Brengle were elected as directors of the Salvage Association for the three years ensuing to take the places of those whose terms expired in March. The Atlantic Mutual, Fireman's Fund, Globe and Rutgers, Providence-Washington and Continental were elected for three years as members of the Board of Managers. Reports were rendered by Mr. Brengle, as acting manager and chief underwriter of the Syndicates, and by Hendon Chubb as chairman of the Underwriting Committee.

Writing War Risks Again

DISTURBED conditions in Egypt and India have led British underwriters to give notice under the cancellation clause in open policies that such covers as include war risks must be terminated so that a readjustment of premiums may be effected. This is because the war risk policies include the risk of strikes, riots and civil commotions—hazards that have been coming prominently to the fore in the East of late.

Seaworthiness

A PERSISTENT rumor comes from London to the effect that the underwriters of that market, upon whom fell the $1,200,000 loss sustained in the burning of the *Northern Pacific* during its run from New York

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to Chester, Pa., are disposed to resist payment on the ground of unseaworthiness, based upon the report of the insufficiency of the crew. Every marine insurance contract carries the implied warranty of the seaworthiness of the vessel. This warranty means not only that the ship is structurally sound but that she is equipped with fuel, stores and a crew sufficient for the voyage upon which she is to sail. This is a question that has been before the courts time and again, and in each instance the size and capabilities of a vessel's personnel have been decided upon the requirements of the particular voyage.

It is extremely doubtful whether the courts would hold with the text-book writers in making seaworthiness a condition precedent which, if not fulfilled, prevents the attachment of the policy. The argument is frequently made that no such rule should be applied in cases where the vessel was unseaworthy at the time of sailing but unseaworthiness did not contribute to her loss. In the well known case of the *Themistocles,* when an action was brought on the bill of lading against the owner of the vessel, the court held that even though she had sailed with boilers in an unseaworthy condition yet she was lost through stress of weather and not because of the state of her boilers, and the owners were held not liable. Phillips is of opinion that if unseaworthiness is corrected before a loss arises therefrom the insurance is not of necessity voided.

Even though the crew of the *Northern Pacific* was large enough to navigate the vessel it may still be necessary to prove that the crew was sufficient to cope with such a fire as might arise in the course of her voyage.

New Type of Lake Carrier

MUCH interest is felt by marine insurers in the proposed improved type of cargo carrier which is under construction for the handling of mixed cargoes from Great Lake ports through the Barge Canal to New York. It is to have a deadweight capacity of about 4,000 tons, will be 300 feet long, 43 feet wide and 24 feet deep. A steering propeller in the bow will aid the rudder, and the engine equipment will probably be of the Diesel type. It is thought probable that this new type will be employed to compete with the proposed direct service to Atlantic ports via the St. Lawrence River.

Underwriters are also interested in the memorandum filed by the Merchants' Association with House Interstate and Foreign Commission opposing the St. Lawrence Ship Canal. This document stresses the economic character of the present lake carrier as compared with the ocean carrier, which will operate on the lakes as the ship canal becomes a reality. The former is admitted to be the most effective type of vessel in the world for the work it has to do.

Liability in Ice-Closed Ports

MATERIAL differentials are generally made by underwriters for summer and winter sailings to Baltic and other northern ports in order to compensate for the ice hazard. Conditions are improving at this time of the year, so far as this feature is concerned, but who is to say what a belated spring may bring forward in those latitudes? In this connection it is of interest to consider a question that is frequently being put up to underwriters as to the liability of the latter for expenses incurred in transshipping cargoes at intermediate ports in event of the port of destination being closed by ice. These costs are not regarded by the underwriter as properly chargeable to him inasmuch as they are incurred by the shipowner in order to facilitate the turnaround of his vessel, and should be borne by the latter as part of the expense involved in earning his freight. The underwriter certainly continues on the risk until the discharge of the goods, and under the clauses of the policy granting the right to transship, and as respects deviation, he would seem to be liable for loss from an insured peril during transit, if the goods were transshipped at an intermediate port and forwarded to destination by rail. Phillips cites an interesting case of a vessel returning to her port of loading after being unable to enter her port of destination because of ice conditions. According to the decision in this case it appears that, if the master returned with the intention of ultimately completing the voyage when navigation opened, the underwriters would continue until the vessel had finally discharged her cargo at the port of destination. As a matter of fact, if the bill of lading required the owner of the goods to pay the expense of transshipment in such a case as that mentioned at the beginning of this paragraph, the underwriter might be willing to defray the cost in order to get off the risk that much sooner.

Salvage Charges Contested

CERTAIN salvage awards made by the Shipping Board are meeting with protest. A considerable number of underwriters feel that insurance interests are not fairly represented and that the salvage charges of the Shipping Board vessels are excessive and unreasonable. Under the salvage methods now employed by the Shipping Board their vessels are directed to proceed to the scene of an accident and to remain by, and this, it is felt, does not work out with fairness to the cargo interests involved. In event of an underwriter contesting a salvage charge in defense of cargo interests on a Shipping Board vessel, the final decision rests with a body that is not regarded as entirely unbiased because of its close identity with the Board.

Rates for Safety Appliances

WHEN promoters of safety devices for shipboard installation request a preferential in the premium rate for such appliances the underwriters generally reply that rates are predicated upon experience and that no credit can be given in the rate until the invention has proved its worth. This is because it is next to impossible to estimate the value of such inventions as far as the safety of a venture is concerned. It is probable that insurance rates have responded right along to the benefits derived from successful inventions that have increased the safety of voyages, as fast as these devices have shown by experience that they warranted it. Rates for ocean insurance have steadily gone down as shipbuilding has improved, and it has not always been because of the pressure of competition. Underwriting profits vary but slightly over a period of years, and the rates would not have come down had results not warranted it. Thus it is clear that added safeguards, minimizing the risks of the underwriters, have made rate reductions possible. Among such proven safeguards may be mentioned the wireless, the radio, numerous fire-fighting and fire-detecting devices, watertight compartments and similar improvements.

The "Model Bill" Becomes Law

MUCH to the gratification of all interested in seeing the way cleared for American marine underwriters to compete on more equal terms with their foreign competitors, the so-called "Model Bill" for the District of Columbia has passed Congress by a comfortable majority vote in both Senate and House and been signed by the President. The purpose of this legislation, as we have frequently pointed out, is to afford an example, or "model," for imitation in State Legislatures so that the handicaps imposed in the forty-eight political divisions of the country may be removed and American underwriters be given a fighting chance with their business rivals.

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National Merchant Marine Association Convenes

President's Message Receives Unqualified Endorsement—Marine Subjects Discussed as a Non-Partisan Issue by Prominent Shipping Authorities

THE annual convention of the National Merchant Marine Association was opened by its president, Senator Joseph E. Ransdell, Friday morning, March 3, in the Rose Room of the Hotel Washington, Washington, D. C. The conventions of this association have come to be recognized as an annual forum for the discussion of matters affecting the merchant marine, and they have been attended by many of the leading representatives of the shipping industry. This particular convention, coming as it did only a few days after the President had delivered his message to Congress, and at what we believe to be practically the beginning of better times for shipping, was no exception to the rule.

Senator Ransdell declared in his opening address that patriotic motives alone and the desire and determination to wisely advise the President on matters relating to handling the colossal problems of American shipping had influenced the Shipping Board to seek light from the best possible sources. The board in reaching its conclusions on the facts and findings that were submitted to the President was assisted by eleven of the best known experts who were chosen regardless of their political belief.

Senator Ransdell then proceeded briefly to analyze the Administration Bill. He said that the subsidy was the essential feature and that, although the term "subsidy" had been an offensive term to the American people of both parties in the past, the situation is altogether different now. He declared that the proposed rebate of 5 percent on the income tax of the total amount of freight paid on exports and imports would reach "the cotton grower of the South, the grain grower of the West and the producer and manufacturer of every portion of the United States who exports his products abroad or imports anything from abroad."

Before introducing the Chairman of the Shipping Board as the next speaker, Senator Ransdell pledged himself, "as one member of the minority party in the United States Senate, to stand by the general principles enunciated in the President's message to Congress." This statement was received with great applause.

Chairman Lasker's Address

The study and recommendations upon which the President's message and the Shipping Bill are based represent "the enthusiastic and the unanimous view of the Shipping Board," said Mr. Lasker. "Senator Ransdell is to be congratulated on being the first man to publicly and favorably analyze the President's message but what would you do," he asked, "if you had prepared an address and the speaker preceding you had covered the same story that you intended to present?"

"The merchant marine is now a vital necessity if America is to live up to its destiny and it is the President's ambition to go into history as the Administration under which it was established," he said. "As to need of a merchant marine, from a naval standpoint there can be no divided opinion." The need exists and there can be no question as to the duty of our people to establish it in a time of peace.

"It is well known that, by and large, American ships cannot compete with foreign vessels unless Government aid insures that they will have to be sold or dismantled. I am one who holds that Section 34 of the Jones Act would have done more than any other aid that could have been given to establish our merchant marine but the President did not consider this in view of our international relations as being in the national interest.

Navigation Laws Not Taken Up

"It is not proposed at this time to change our navigation laws. This is a subject in itself, but I believe that I can speak with authority when I say that the spokesman of sea labor feels that there are certain much-complained-of provisions in our navigation laws which in due course should be modified.

"It is proposed that the board sell its ships at world prices so that the owners will not be burdened with capital charges exceeding those of foreigners. The board cannot meet the need for passenger ships but it is possessed of an ample fleet of cargo ships to meet any needs for years to come.

"We have asked Congress to give us a constructive loan fund of $125,000,000 as soon as possible to be loaned at not less than 2 percent interest for the construction of the modern types of vessels that we lack. This is provided for in the Jones Act at the rate of $25,000,000 a year for five years but we have asked that the entire sum be made available at once for shipowners to give work to American yards who sorely need it.

"Referring to the income tax provisions, I should like to make clear that 5 percent of all freight moneys that have been paid to American ships for either inbound or outbound cargoes shall be deductible from the income and corporation taxes. This provision is in lieu of the benefits that would have accrued to American shippers from Section 34 of the Jones Act. It will benefit all shippers and insure full cargoes for American ships.

Immigration

"It is proposed to secure at least 50 percent of the immigrant traffic for American vessels and, from such countries as do not possess a merchant marine, 100 percent. If this provision had been a law during the time that immigration was at its peak, we would not have been in the sorry plight that we were in 1914 when we had only 15 ocean-going passenger ships.

"The Naval Reserve will cost about $650,000 the first year and reach a maximum of $3,000,000 when 30,000 men will receive an annual retainer of one month's pay for their naval rating. This provision would be the greatest insurance against hasty and expensive naval training such as was entailed in our last war.

"Government officers going abroad on official business will be forced to travel on American ships when such are available or pay for their passage out of their own pocket.

"It is proposed in the law to discontinue the Army and Navy Transport Service and transfer their patronage to privately-owned vessels. I believe that if the real figures were available it could be proved that it can be done much cheaper in privately-owned ships.

To Bring Philippines Under Coastwise Laws

"The same objections that we heard against bringing Hawaii and Porto Rico under the coastwise laws are brought forward to show that the Philippines should not be made to come under these laws. Since Hawaii and Porto Rico have been brought under the coastwise laws they have prospered as they never prospered before. In fact, anything that is proposed to be done for American ships meets with the same kind of false propaganda.

"Preferential rail rates on through-shipments by American ships is now a law of the land. The Shipping Board is

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making an intensive study as to whether the adequate facilities as required by the law are in existence and, if such facilities exist, the Shipping Board will direct their enforcement.

Subsidy

"The direct aid is based on a combination of speed, tonnage and distance covered. It will cost about $15,000,000 the first year and will reach $30,000,000 at the end of five years. I will not go into details about the rates of compensation proposed but by the use of the formula worked out we will get a balanced merchant marine of the types of ships needed to properly cover our trade routes. The funds are to be derived from 10 percent of the custom receipts and from doubling the present tonnage taxes. The ships receiving aid will not be paid for the carriage of the mails, excepting parcel post, but the sum due for this will be paid by the Post Office into the merchant marine fund and should amount to about $5,000,000.

A Check Against Profiteering

"In order that there could be no charge of profiteering, the proposed law contemplates that the direct aid shall follow the individual ship to the extent of 10 percent of its earnings in any one year. The earnings above 10 percent are to be equally divided between the Government and the shipowner until the subsidy has been repaid after which the ship keeps all its earnings. Where the indirect aids are sufficient, the direct aid would come back to the Treasury. It is an automatic check on itself.

"If in certain trade, such as Australia, the aid proposed should not be sufficient, the Shipping Board is authorized to increase it. If, however, the Shipping Board makes an error in the amount of aid it gives, automatically a check is on the error, because after 10 percent, half of the profits go back to the Treasury.

"Here is a definite remedial and creative proposal. If you don't want to accept it, what have you to offer? But don't bring up the genius of America for she has no greater genius for the sea than other nations. If ignorance, if selfish interest, or those who profit by the *status quo* are able to confuse the issue, the opportunity of the moment which peculiarly calls for action will pass."

Congressman Scott's Address

Representative Frank D. Scott of Michigan gave some idea of the importance of foreign trade when he stated that $4,000,000,000 worth of manufactured products should be shipped abroad annually, and also that 2 out of every 10 bushels of wheat must be exported. He claimed that the discontinuance of discriminatory duties in the last century killed our merchant marine and that the Seaman's Act was doing the same thing now.

He said the Seaman's Act affected the Great Lakes shipping much more severely than the ocean and that Great Lakes shipping cannot prosper until this difference is recognized. He asserted that not one of the passenger and cargo vessels on the lakes is now stopping at the islands or intermediate points.

Mr. Scott then took a shot at the Shipping Board by saying that it had been created as a first aid and then promoted to family physician. "Duplication is a great evil," he said, "the Shipping Board should be abolished and all its functions transferred to the Department of Commerce."

Demand for Passenger Accommodation

According to Mr. W. A. Harriman, who was the next speaker, a good indication of the demand for passenger accommodations is the number of inquiries that are received every day at the offices of the United American Lines for space on the new liners *Resolute* and *Reliance*. These vessels, which are the latest and most modern additions to the transatlantic passenger service, will be filled to maximum capacity during the coming season.

Mr. Harriman said that it was encouraging to know that the country was beginning to realize the importance of the work that the shipowners are doing and that this work could only be efficiently carried on by private interests.

Mr. Harriman pointed out the advantage that Great Britain had over us in the matter of ships of specialized design. He said that even in the cargo ship class they had vessels that could steam at 15 knots with which on certain berths our 10½-knot vessels could not successfully compete.

A Good Business Proposition

Commander Stevenson Taylor, president of the American Bureau of Shipping, declared that he knew of no better business proposition for the country at large than the wise expenditure of from thirty to fifty million dollars per annum so that our immense fleet of merchant ships can be operated profitably under private ownership. He said in part:

"Foreign shipping to us, after a lapse of over a century of inanition, is a new industry. It is now the one industry in the United States which needs protection by Governmental means more than any other. Every other of our great industries has had Governmental protection—a protection that has increased the cost of ships—and has a natural protection due to the geographical location of the United States, that is to say, the protection of at least 3,000 miles of water on both sides of this continent. Only three miles from our shores the ships of the world meet on an equality of opportunity.

"We cannot expect to maintain American standards of living on the seas, and compete successfully with ships operated under the lesser standards of our competitors. It then becomes necessary for our Government to see that American ships are given the same protection which our other basic industries have and should receive wherever economic conditions make it necessary.

"We must have our own delivery system, if we are successfully to sell our excess products in markets open to world competition, a delivery that will protect our shipments against delays and against damage caused, as has been asserted, either by wilfulness or carelessness. If we do not dispose of all our surplus products our national business will not continue to be successful. Hence, if we treat our shipping in the foreign trade solely as a delivery system, it is worth whatever it may cost, when we consider the business of the entire nation."

The Middle West Attitude

"Aside from the fact that we must maintain a fair-sized merchant marine in order to make our Navy effective, the Middle West looks upon the merchant marine as a means to an end," said Malcolm E. Stewart, chairman of the Middle West Merchant Marine Committee. He advocated the arrangement of conferences in the principal industrial and agricultural centers of the interior. In this way, the manufacturer, producer and business man can coordinate their interests to such an extent that each of them is bound to see the advantage of joining forces.

"Although the only way that we can get the kind of service best suited to expand our foreign trade is by building up an American merchant marine," he declared, "every convenience is offered to ship over foreign lines. The agents of the foreign shipper are ever bombarding the shipper with detailed information, making him familiar with the details of making shipments on every kind of a ship except an American, while the American steamship companies have not gone after this business with the proper spirit of cooperation and helpfulness."

Mr. Stewart said that the shippers of the United States

(*Continued on page* 244)

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Fireboat John Purroy Mitchel

By I. C. G. Cooper*

The commissioning of the John Purroy Mitchel brings the number of fireboats comprising the marine division of the New York Fire Department to ten, or one vessel to every 58 miles of the city's waterfront. The enormous shipping activities carried on in the port of New York place a heavy responsibility upon this branch of the Fire Department and the rare occasions of loss or damage by fire are due to the thoroughness with which it works.

THE latest addition to the floating fire-fighting equipment of the New York Fire Department is the up-to-date vessel recently built and delivered by the Standard Shipbuilding Corporation at Shooters Island, N. Y.

The *John Purroy Mitchel* is a notable example of modern fireboat design. The particulars of the vessel are as follows:

General Information

Service: Fireboat for New York Harbor.
Builder: Standard Shipbuilding Corp., Shooters Island, New York.
Owner: Fire Department, City of New York.

Characteristics

Length, overall	133'-7½"
Length, B. P.	121'-0"
Breadth, molded	27'-0"
Depth, molded	14'-9"
Draft, loaded	9'-6"
Draft, light	
Block coefficient	0.58
Midship section coefficient	0.95
Longitudinal coefficient	0.61
Speed, loaded, knots	10.5
Cruising radius, nautical miles	
Framing	Transverse
Class	American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds.)

*Weight of Hull	207
**Weight Propelling Machinery	180
Deadweight Capacity	
Displacement	476

(In tons of 100 cubic feet.)

Gross register	334.75
Net register	227.63

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, Machinery Space Auxiliaries, Fire Pumps and Pipe System.

Equipment

Anchors, (1) stockless	350 lbs.
Chain, ⅝" galvanized B.B.B.	20 fms
(10) Fenders, oak with manila lanyards	

Rudder

Area, square feet	52.6
Dia. Stock, inches	6

Deck Machinery

Steering Gear, Hyde	5½"x5½"
Capstans, (1) Hyde	4½"x6"

Life Saving Equipment

	No.	Type	Length
Lifeboats	1		12'-0"
Liferaft	1		7'-4"x4'-0"

Propelling Machinery

Boilers

Number	2
Type	B. & W, watertube
Length	9'-0"
Width	9'-8"
Furnaces, per boiler	3
Fuel	oil
Draft	forced
Total heating surface, square feet	4,840
Working pressure, lbs. per sq. in.	200

Engines

Number	1
Type	Reciprocating
Size	18"x38"x26" stroke
Horsepower, indicated	720

Propellers

Number	1
Type	R. H., 4 bladed, semi-steel
Weight, tons	1.61
Diameter	8'-8"
Pitch	10'-6"
R. P. M.	140
Projected area, sq. ft.	22 6
Developed area, sq. ft	28.0

Auxiliary Machinery

Machinery Space

Condensers (1)	2,500 sq. ft. cooling surface
Feed water heater	1
Fuel oil heater, Coen type	6 section
Pumps:	
(2) Oil fuel	6x4x6
(1) Air	9x18x9x18x12
(1) Main feed	9x6x10
(1) Donkey	9x6x10
(1) Circulating	12" centrifugal
(1) Fresh water	4½x2¾x4
(1) Sanitary	4½x2¾x4
(2) Turbo driven fire rotary type.	

Electric Equipment

Generator, (1) 10 k.w. 110 volts, 91 amperes	
Radio	
Emergency	

Bunkers

Compartment	Cu. Ft.	*Tons
F. O. tank, port	870	22.3
F. O. tank, star	720	18.4
Total	1,590	40.7

*39 cu. ft. per ton ..... gals. per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
F. W. forward	1,200	33.3	..
F. W. aft	480	13.3	..
Total	1,680	46.6	..

Hull

The hull is built to meet the requirements of the American Bureau of Shipping and is further strengthened to withstand the possibility of work in ice, in the extensive waterways around the city, by closely spaced frames forward, additional breast hooks and thickened bow plating.

Two sturdy oak fenders extend along the sides. The upper, 10 inches by 10 inches, extends completely round the vessel at the level of the main deck and the lower, 8 inches by 8 inches, located 2 feet above the waterline, extends from the fore end aft for four-fifths the length. Each fender is faced with 6-inch by ¾-inch flat steel bars.

Angle bar framing is used with solid floors and reverse bars extending 18 inches above the top of the floor plates. The reverse bars are double in the engine room and on alternate frames in the boiler room. Beams are fitted on alternate frames.

The single deck has substantial stringers and tie plates and is sheathed with 3-inch Oregon pine 3½ inches wide with a 7-inch yellow pine margin.

A feature of the vessel is the spacious nature of this deck, allowing easy access to the various fire turrets and hose reels and permitting free action for the firemen at every point.

Spacious quarters are provided for firemen and officers forward and for engineers aft. Berths are of the single spring type with lockers underneath. A washroom for stokers is directly accessible from the stokehold through a passage, fitted with airtight doors at each end, which also forms the swash bulkhead of the oil fuel tank.

A well lighted workshop aft is fitted with two large benches and has ample locker and shelf stowage.

The entrance to the forward quarters, under the pilot house, is utilized as a nozzle room.

Main Propelling Machinery

The main engine is of the reciprocating, surface condensing type consisting of high pressure and low pressure cylinders with balanced cranks placed at right angles. All desirable

*Assistant to the naval architect, Standard Shipbuilding Corporation.

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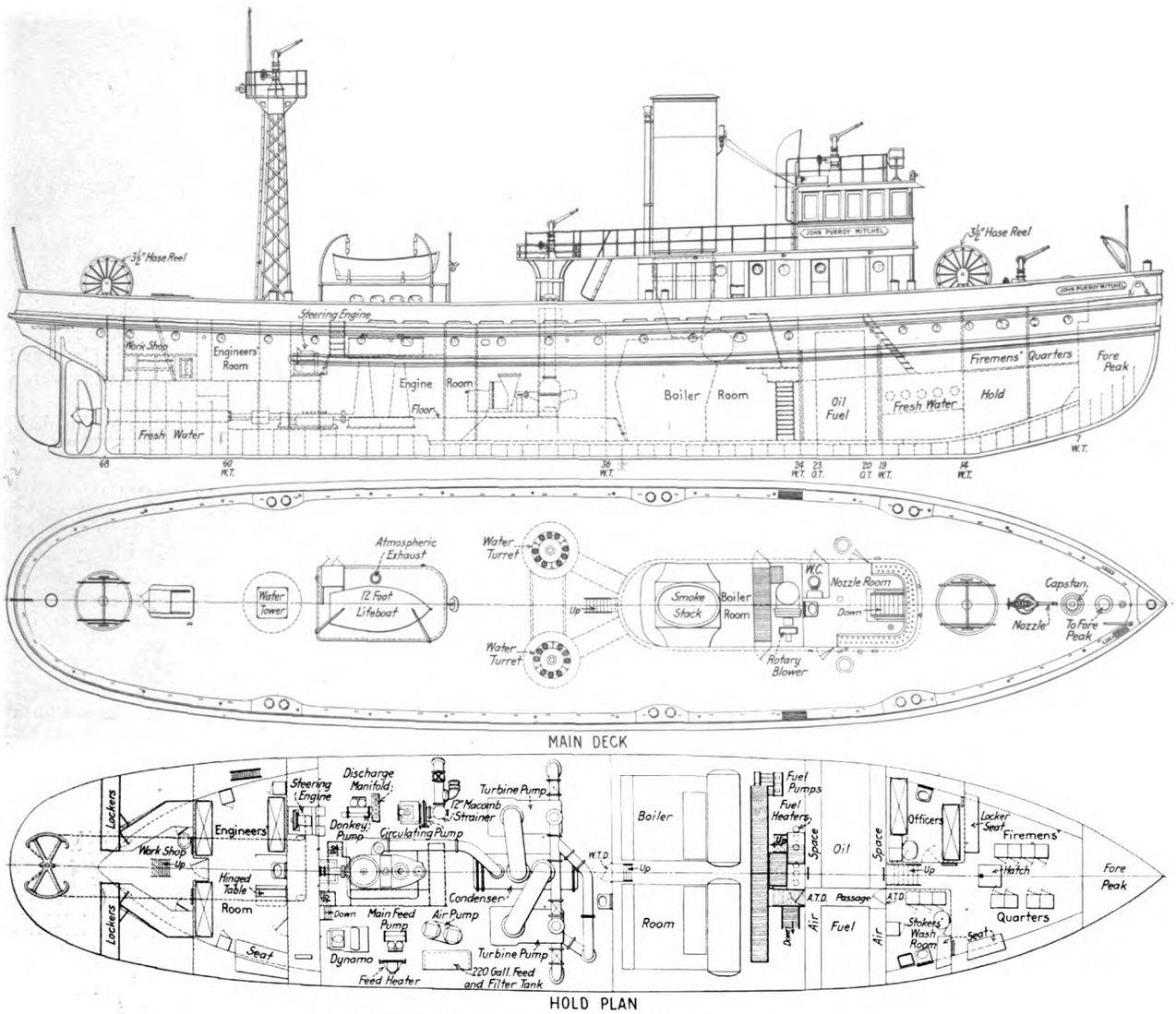

Profile and Deck Plans of Fireboat John Purroy Mitchel

auxiliaries have been fitted as shown in the table of particulars.

Boilers

The boilers are of the Babcock and Wilcox watertube type with large straight tubes designed for 200 pounds pressure and equipped for burning oil fuel on the system supplied by the Babcock and Wilcox Company at Bayonne, N. J.

The total capacity of the boilers is 29,000 pounds of dry steam per hour when working in a closed stokehold under a supply of 18,000 cubic feet of air at 1½ inches pressure. The air pressure is maintained by a rotary blower placed in the fireroom entrance at the main deck level, drawing from a 26-inch diameter geared cowl and delivering directly into the fireroom.

Oil fuel is stored in a special bunker, forward of the boiler room, protected by air spaces at the ends and on top.

The deck over the boilers is protected by 3/16-inch asbestos millboard laid over a complete sheathing of 6-pound plating.

Fire-fighting Equipment

A feature of the vessel is the completeness and power of her fire-fighting equipment. Water is delivered by rotary pumps, turbine driven, having a total capacity of 7,200 gallons of salt water per minute at a pressure of 175 pounds, or 9,000 gallons at a pressure of 150 pounds per square inch. The power is provided by two impulse type turbines developing 600 brake horsepower at 2,000 revolutions per minute under steam pressure of 200 pounds and exhausting into a condenser with 26-inch vacuum. The pumps are also cross connected so as to provide together a delivery of 4,500 gallons at 300 pounds pressure. The water is distributed through five large swivel nozzles mounted on the pilot house, after tower and forward deck and also through two midship turrets, each having 9 connections for hose.

Swivel play pipe holders are fitted at regular intervals in the 12-inch by 4-inch oak rail on the bulwark which is heavily constructed for this purpose.

Two reels on turntables, one forward and one aft, afford stowage for 1,000 feet of 3½ inch hose and two others are to be supplied which will stow 1,000 feet of 2½ inch hose and 1,000 feet of 1½ inch hose, respectively.

The substantial and workmanlike finish of the hull, machinery and fitting of the vessel, together with the up-to-date nature of the pumps make this a valuable addition to the city's fire-fighting force and will admit of a better distribution of the fireboats now in commission.

Trials

The boilers on trial were found capable of a much higher

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evaporation than the contract called for. At one trial 35,000 pounds of steam were produced per hour against the specified 29,000 pounds.

Satisfactory results were also obtained with the turbine pumps.

The final full power speed trials were carried out on the Hudson River mile on November 9, 1921, in rather rough weather. Six runs were made with the following results:

Run No.		Speed in Miles	Propeller Revolutions per Minute
1	Against wind and tide....	13.28	160
2	With " " "	15.31	160
3	Against " " "	13.13	150
4	With " " "	15.42	150
5	Against " " "	13.33	150
6	With " " "	15.72	150

The mean speed was 14.3 miles per hour, and at 140 revolutions the speed was 13.75 miles per hour. Complete circles were turned both to port and to starboard in 2 minutes 12 seconds.

At 150 revolutions it took 24 seconds to completely stop the vessel when the engines were reversed.

The vessel was designed by Messrs. J. W. Millard & Brother, naval architects, 17 State street, New York, and the details were developed by the builder's drafting staff under the direction of Mr. Peter Mitchell, naval architect. Mr. F. Thompson, assisted by Mr. J. Woods, represented the Fire Department during construction.

ORGANIZATION OF MARINE DIVISION, NEW YORK FIRE DEPARTMENT

There are now ten fireboats comprising the marine division of the New York Fire Department and each boat has a certain area that it covers on a first alarm. Two boats usually respond at each waterfront fire and if, during the absence of either of these boats, a second fire occurs, the boat from the adjoining district will respond. At least one boat responds to every waterfront fire. It is also possible to concentrate all boats at any particular point by means of a special signal.

An added duty and service of the fireboat fleet is to supply the high pressure mains in lower Manhattan and Brooklyn with salt water in an emergency. They can also be used to relay water to land engines operating a great distance from the waterfront, if for any cause the water supply has failed.

At a very serious fire the auxiliary fireboats, consisting of the tug boats of the various railroad companies, oil companies, steamship companies, etc., are called by a special signal to the Fire Department dispatcher at headquarters. These auxiliary fireboats are all equipped with pumps and have in the past performed effective work at fires.

The waters about the city of New York are at present divided for fireboat operation into districts as follows:

New York Harbor from Scotland lightship to buoy off Rockaway Point, Jamaica Bay, Staten Island Sound, Hudson River to Yonkers, East River including Gowanus Canal, Wallabout, Bushwick and Newtown Creeks, Harlem River, Long Island Sound, bays and tributaries to Sands Point.

The fireboats covering these districts are:

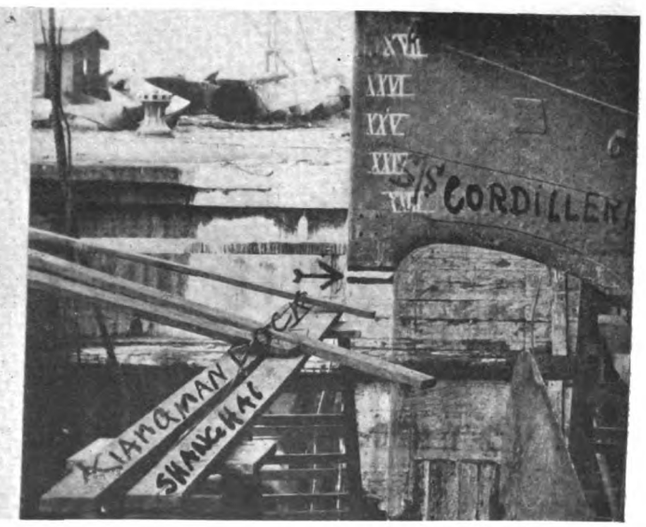
Name	Station	Length	Capacity in Gals. per Min.
The New Yorker....	Battery	136'6"	12,000
Wm. L. Strong.....	Grand St., East River.....	110'0"	6,000
Zophar Mills.....	Beekman St., East River..	120'5"	6,000
George B. McClellan.	99th St., East River.....	117'0"	7,000
James Duane.....	35th St., North River.....	131'0"	9,000
Thomas Willett.....	Bloomfield St., North River	131'0"	9,000
Cornelius W. Lawrence	135th St., Harlem River...	104'6"	7,000
Wm. J. Gaynor.....	37th St., South Brooklyn..	118'0"	7,000
Abram S. Hewitt....	Foot of Noble St., Brooklyn	117'0"	7,000
John Purroy Mitchel..	Not assigned	132'0°	9,000

In addition to their duties about the city of New York, these fireboats have on numerous occasions rendered aid to cities and towns along the New Jersey shore.

Oxy-Acetylene in China

THAT China, a country whose worship of antiquity has retarded its own development and progress until comparatively recently, is at last awakening to ideas and activities of the fast moving world beyond her domains is evident in many ways. One of these that is typical of her newfound modernism is the adoption of oxy-acetylene welding and cutting.

Welded Section of Rudder Frame



Welded Stern Post

The photographs reproduced herewith were secured through the courtesy of the Export Department of the Oxweld Acetylene Company. They show interesting work done by the Oxy-Acetylene Welding Works, at Shanghai. A rudder frame of the French S. S. *Cordillere* was broken, and the ruptured section (9 inches by 5 inches) was repaired by welding in four hours. The location of the weld is shown by crossed chalk lines in the photograph at the left. Another weld (on the stern post) is indicated by the arrow in the picture on the right. The work was done by Chinese labor.

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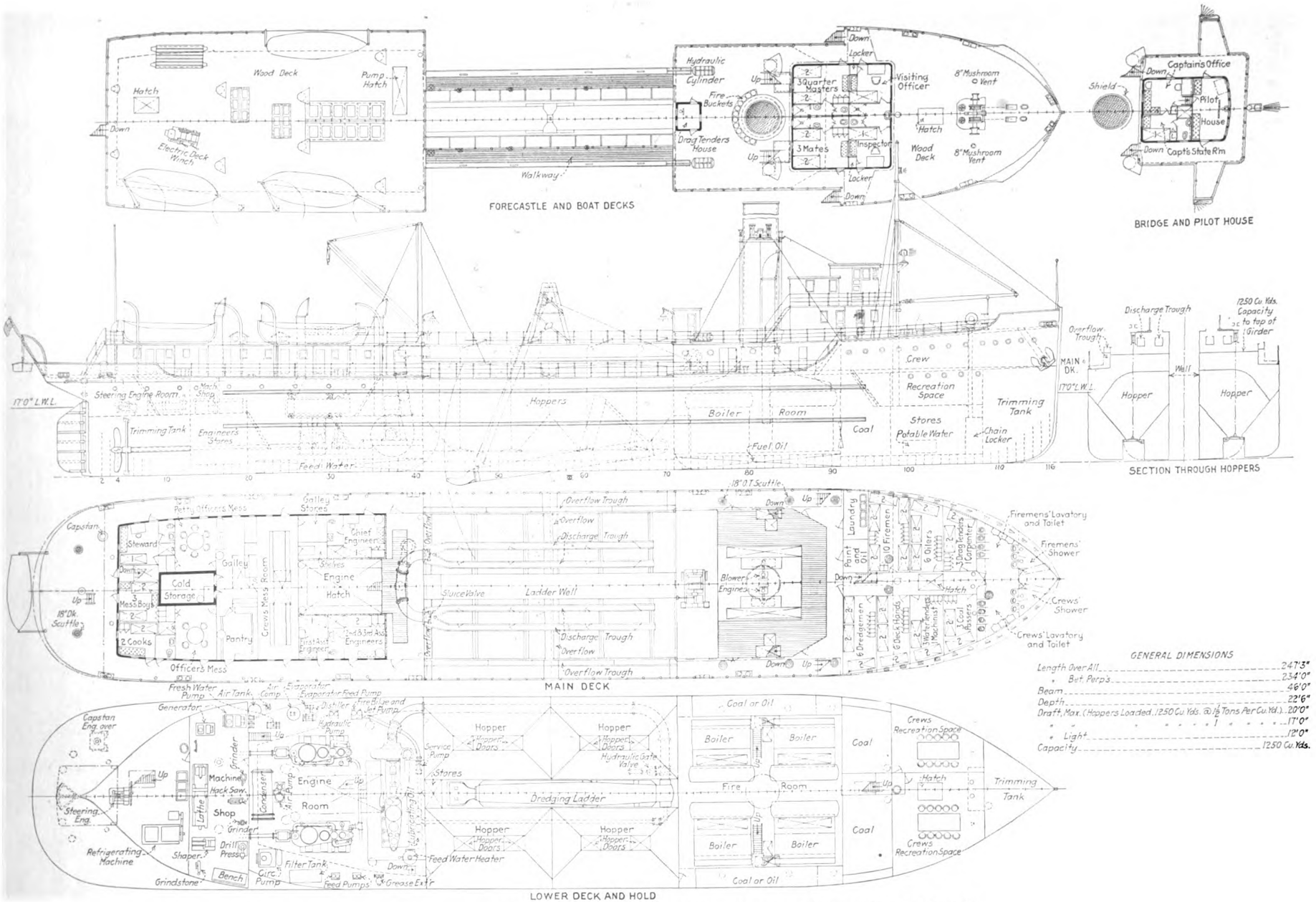
FORECASTLE AND BOAT DECKS
BRIDGE AND PILOT HOUSE
SECTION THROUGH HOPPERS
MAIN DECK
LOWER DECK AND HOLD
GENERAL DIMENSIONS
Length Over All 247'3"
" Bet. Perp's 234'0"
Beam 46'0"
Depth 22'6"
Draft, Max. (Hoppers Loaded, 1250 Cu. Yds. @ 1½ Tons Per Cu. Yd.) 20'0"
" " " " " " " " 17'0"
" Light 12'0"
Capacity 1250 Cu. Yds.

General Arrangement Plans of Sea-Going Hopper Dredge of 1,250 Cubic Yards Capacity

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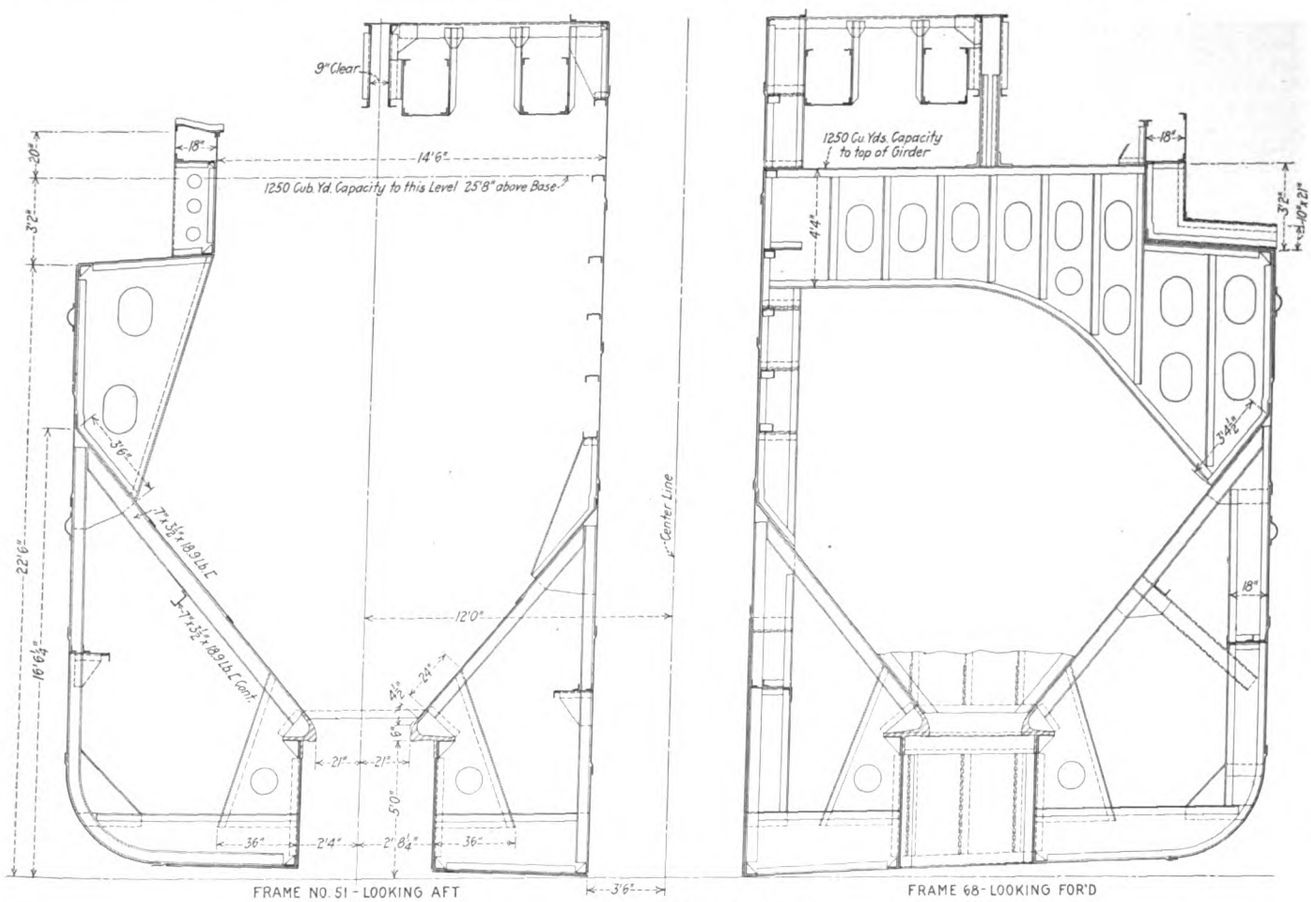
Sea-Going Dredge of 1250 Cubic Yards Capacity

Latest Design of Hopper Dredge for Use by the United States Engineer Department on Bar Dredging

By Theodore R. Vogel* and L. D. Norsworthy†

THE following description of the seagoing hopper dredge recently designed, under the direction of Brigadier General Harry Taylor, in the Marine Design Division of the Office of the Chief of Engineers, War Department, brings out many points of improvement over the former design of a similar type. The design follows very closely that of the *Col. P. S. Michie* which has the drag located in a well at the center of the hull and which was designed in the Office of the Chief of Engineers about ten years ago.



Transverse Sections Through Hoppers

The *Col. P. S. Michie* was designed primarily for use at Coos Bay, Oregon, where the severe weather conditions encountered made a specially designed dredge necessary for successful operation. This dredge has been in continuous operation since its construction in 1914 and has proved itself so superior to all other types that at a conference, held in the Office of the Chief of Engineers in February, 1920, it was agreed that future designs should be of the center well type with such improvements as have been developed since the *Col. P. S. Michie* was designed.

Criticisms of the hopper dredges in the various Engineer Districts of the War Department were received from the United States Engineers in charge of the districts with suggestions for their improvement. These criticisms were carefully analyzed and the following general principles established for the future design and operation of dredges:

(a) That a dredge is an expensive craft and economy is attained only when it is kept at work the greatest possible time throughout the year.

(b) That dredges of small capacity are uneconomical in operation as not enough space is available for a crew sufficient to operate the dredge twenty-four hours a day.

(c) That the machinery must be of the most efficient type and of such rugged construction that it will stand up under almost continual use, with the amount of time required for repairs, renewals, etc., reduced to a minimum.

In deciding to design a dredge of the center well rather than the stern well or side drag types, the following advantages of the former over the latter two types were considered:

The weight of the drag arm acts somewhat as a centerboard and thus tends to steady the dredge in rough weather. Further, after the drag has been lowered it remains on the bottom and at work practically all the time. This is a decided advantage over the side drag type where the drags

*Assistant engineer, in charge of Marine Design Division, Office of Chief of Engineers, War Department, Washington, D. C.
†Leading ship draftsman, Office of Chief of Engineers, War Department, Washington, D. C.

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Sea-Going Hopper Dredge

General Information

Service: Bar Dredging.....
Builder .....
Owner: Engineer Department, U. S. Army .....

Characteristics

Length, overall .....247'-3"
Length, B. P. .....234'-0"
Breadth, molded .....46'-0"
Depth, molded .....22'-6"
Draft, loaded with 1,250 cu. yds. at 1 ton per yd. .....17'-0"
Draft, loaded with 1,250 cu. yds. at 1½ tons per yd. .....20'-0"
Draft, light .....12'-0"
Block coefficient, 17 ft. W. L. 0.772
Midship section coefficient, 17 ft. W. L. 0.975
Number of hoppers 4
Capacity of each hopper, cu. yds.....312.5
Total capacity of hoppers, cu. yds. ..1,250
Displacement, tons, light 2,550
Displacement, tons, loaded with material at 1 ton per cu. yd. 3,800
Displacement, tons, loaded with material at 1½ tons per cu. yd. 4,575
Tons per inch immersion, 17 ft. W. L...21.5
Dredging depth, feet 45

Equipment

2 Bower anchors, stockless, each..3,500 lbs.
1 Stream anchor, stockless .....1,000 lbs.
Chain cable, 1⅞" stud .....1,440 ft.

Rudder

Area .....
Dia. Stock ...'.....
C. Press. C. L. Pintles.....

Complement

Officers 12
Crew 50
Shifts 3

Handling Equipment

	No.	Type	Capacity	Length
Masts	1	Pole		
Derrick posts	2			
Booms	1		5-Ton	
Booms	2		10-Ton	

Deck Machinery

Steering Gear, Steam driven type, telemotor control.
Windlass .....(1) 8" by 8" double engine
Capstans.....(1) 6" by 8" double engine
Winches ..(1) 2½ tons, electric single line Drag Hoist, (1) double line, 60 feet per minute, 22,400 lbs.

Life Saving Equipment

	No.	Type	Length
Lifeboats	2	Metallic	24'-0"
Launches	1		24'-0"
Workboat	1		18'-0"
Life raft	1		14'-0"

Propelling Machinery

Boilers

Number 4
Type .....Watertube
Length .....
Width or Dia.....
Furnaces .....
Fuel .....Oil or coal
Draft .....Induced
Total heating surface, square feet ...11,040
Total grate surface or furnace volume.....
.....
Superheat, degrees F. 60
Working pressure, lbs. per sq. in. 225
Normal fuel consumption:
Per day, tons .....
Per horsepower hour, pounds.....
Normal steam production:
Per hour per pound of fuel.....lbs.
Total per hour .....lbs.

Engines

Number 2
Type .....Triple expansion
Size .....15"x26"x44"x26" stroke
Horsepower, indicated 900

Propellers

Number 2
Type .....
Weight .....
Diameter .....12'-0"
Pitch .....
R. P. M. 100
Projected area .....
Developed area .....

Auxiliary Machinery

Machinery Space

Condensers, (1) 3,600 sq. ft. cooling surface
Evaporators (1) .....8,000 gals. per day
Distiller (1)..... 4,000 gals. per day
Feed water heater .....Surface multicoil
Fuel oil heater .....Auxiliary steam
Pumps:
1 Main circulating, 12" centrifugal
1 Air, 12"x20"x12" duplex
2 Feed, 8"x5"x12" duplex
1 Fire, bilge and jet, 12"x10"x12" duplex
1 Hydraulic, 10"x6"x10" duplex
1 Fresh water, 4½"x4"x4" duplex
1 Sanitary, 4½"x4"x4" duplex
1 Service, 4½"x4"x4" duplex

Pumping Engine

Number 1
Size .....13½"x26¼"x36¾"x24" stroke
R. P. M. 145
Horsepower, indicated 750
Type .....Triple expansion

Dredging Pump

Number 1
Size of suction .....26"
Size of discharge .....26"
Diameter of impeller .....6'-9"
Number of blades 5
Width of blade between shrouds .....14"
Thrust .....Kingsbury

Shop Machinery

1 16" Lathe
1 18" Shaper
1 22½" Drill press
1 Emery grinder
1 Grindstone
1 Hacksaw
1 Drill grinder
Hopper Door Handling Machine
2 Hydraulic cylinders, 16" diameter by 4'-0" working stroke with pressure at 300 lbs. per sq. in.
Refrigerating Machinery
Type ..... Dumbbell
Capacity .....2 tons
Electric Equipment.
Generators:
1 15 K. W. set
1 10 K. W. set

Bunkers

Oil

Compartment	Bbls.
2 Side bunkers, 650 bbls. each	1300
2 Bottom bunkers, 320 bbls. each	640
Total bbls.	1,940

Coal

	Tons
2 Side bunkers 75 tons each	150
1 Transverse bunker	200
Total	350

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Feed water, double bottom	100	....	

are continually lifted from the bottom due to the roll of the vessel, and also, if there is a cross current or cross wind, the offside drag has to be constantly lifted to prevent the dredge from sitting on and breaking the drag pipe. In regard to the stern well type the inherent disadvantage is that it will not steer well due to the heavy drag at the stern acting as an anchor. With the drag in a center well it is almost under the turning point of the vessel so that the dredge in steering practically uses the drag as a pivot on which to turn. Size for size the center and stern well types are both at a disadvantage when compared to the side drag type due to loss of buoyancy in the wells. This, however, is not considered serious as the increase in draft is comparatively slight. Then again the hull has the appearance of a commercial vessel with clear sides and has not the difficulty in lying at a wharf or making a landing that a dredge with drags, drag pipes, sponsons and davits on the sides does.

It was agreed that two sizes would be designed, one of 1,250 cubic yards capacity and one of 2,500 cubic yards capacity; the first dredge to have a load draft of 17 feet, with material in hoppers weighing one ton per cubic yard, and be of sufficient depth to give a freeboard of 2 feet 6 inches when loaded with material in the hoppers weighing 1½ tons per cubic yard; the second dredge to have a load draft of 20 feet with material in the hoppers weighing one ton per cubic yard and be of sufficient depth to give a freeboard of three feet with material weighing 1½ tons per cubic yard in the hoppers.

So far only tentative plans have been made for the second dredge.

Improvements Over Previous Designs

The points considered improvements over previous designs are as follows:

(1). Continuous main deck.
(2). Location of all quarters above the main deck.
(3). Provision for recreation space for the crew.

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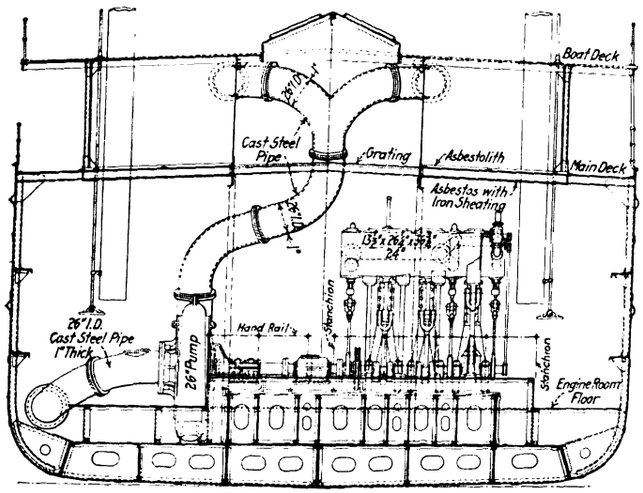
(4). Provision for sufficient quarters for three shifts of crew.
(5.) The elevation of hopper doors so that when opened they will not project below bottom of vessel. (This arrangement will allow the hoppers to unload should the dredge ground.)
(6). Omission of hips between the doors in each hopper.
(7). Replacement of hopper door chains with rods and the use of cast steel for the hopper doors and frames.
(8). Provision for dumping hoppers singly.



Transverse Section at Frame 35, Looking Forward, Showing Dredging Pump and Engine

(9). Provision for a 20-inch water cushion at the top of the hopper.
(10). Provision for a double discharge trough over each set of hoppers so that the discharge streams will oppose each other, tending to quiet the water and allow a better settlement of the dredged material.
(11). Overflow troughs from hoppers located outside of hoppers with discharge above deck.
(12). Increased length of dredge arm for dredging to a depth of 45 feet with arm at an angle of 43 degrees to the horizontal.
(13). Underside of dredging ladder fitted with plate so that center well is practically closed at bottom when ladder is in a horizontal position, thereby reducing eddy formation and increasing speed when dredge is under way.
(14). Lighter and narrower drag head.
(15). Water jets for drag, for use in dredging stiff material.
(16). Location of the drag operator's house and drag hoisting machine at forward end of hoppers so that the operator has a clear view of the discharges and the drag lines at all times and to increase the length of the leads from the drag hoist frame.
(17). Passageway from engine room to boiler room.
(18). Provision for greater accessibility to dredging pump.
(19). Provision for lifting dredging pump directly out of engine room.
(20). Installation of a dredging pump having a larger suction mouth and easier stream lines into the impeller.
(21). Increase in power of propelling engines to 900 indicated horsepower each.
(22). Triple expansion propelling engines.
(23). Installation of propellers with detachable blades.
(24). Outboard shaft protection device provided.
(25). Increased boiler capacity so that any three of the four boilers will furnish sufficient steam for maximum operation.
(26). Installation of steam superheaters.
(27). Installation of evaporator plant.
(28). Increase of fuel and water supply to provide for one week's operation.
(29). Provision for carrying either fuel oil or coal.
(30). Telemotor control for steering engine.
(31). Provision for hand steering.

The changes outlined above necessitated increasing the length 5 feet, breadth 3 feet and the depth 2 feet 6 inches over similar dimensions of the *Col. P. S. Michie.*

When the dredge is handling heavy material an additional 100 cubic yards can be carried in the hopper by eliminating the water cushion.

OPERATION

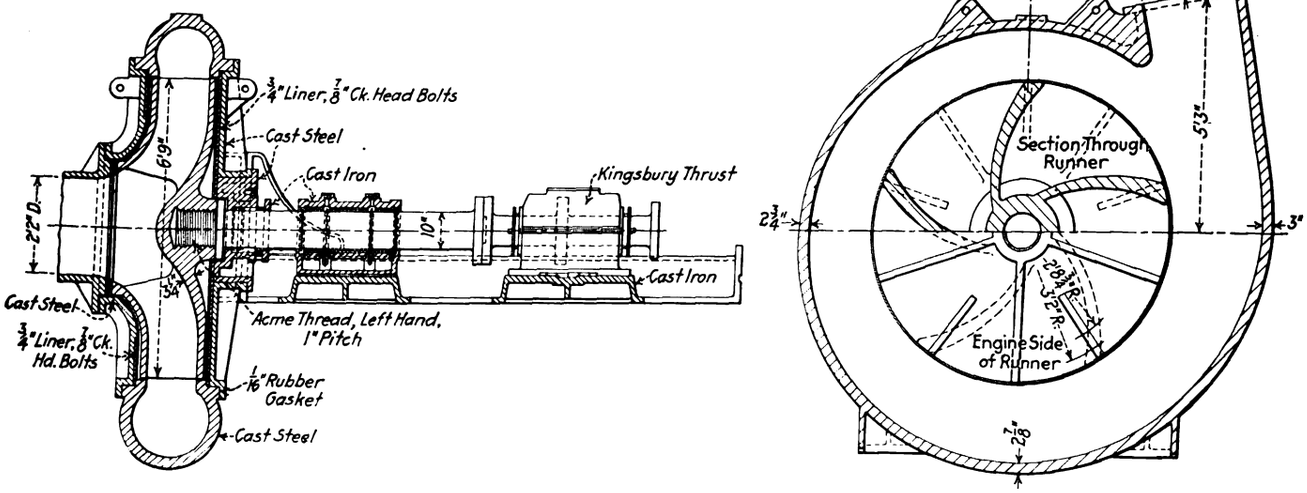
In operating, the dredge is kept moving forward at a speed of from one to two miles per hour with the drag down. The material is sucked up through a grid in the suction head, passes up through a 26-inch pipe in the drag arm to the trunnion, thence aft to the dredging pump. Just above the pump a "Y" pipe is fitted leading to double discharge troughs on each side of the well. These discharge troughs empty through adjustable doors into four large hoppers, each hopper having a pair of gates at its bottom.

Each hopper is fitted with an outboard and end weir, arranged to permit waste water to overflow into troughs which discharge overboard across the main deck.

The hoppers and machinery have been so located that the dredge will trim practically on an even keel with no load or full load in hoppers, which allows an even flow of water into the overflow troughs. When the hoppers are full the dredge proceeds to the dumping ground, where the material is deposited by opening the hopper gates.

The drag arm, which contains a 26-inch suction pipe, is connected to the hull by means of heavy cast steel trunnions and is raised and lowered by means of wire rope falls.

Accommodations are provided for three shifts of crew to permit continuous operation of the dredge.



Details of 26-Inch Dredging Pump

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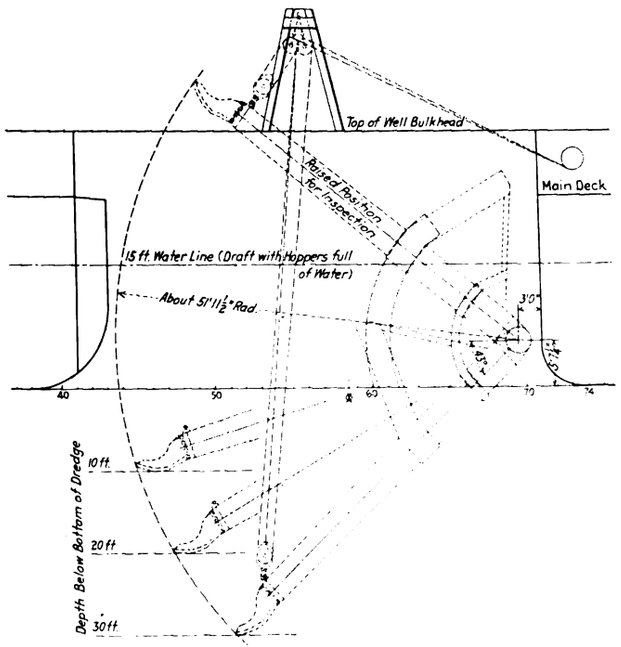


Dredging Depth Diagram

The crew, firemen, oilers, etc., are berthed forward in commodious quarters in the raised forecastle.

Recreation rooms are provided on the lower deck forward where those off duty may lounge or read.

The engineers are berthed in quarters near the engine room and the deck officers in an upper deck house forward.

The captain's stateroom and office are located immediately aft of the pilot house.

Propelling Machinery and Boilers

The propelling engines, of which there are two, are of the triple expansion type capable of developing 900 indicated horsepower each at 100 revolutions per minute.

Four watertube boilers are provided of such capacity that any three will provide sufficient steam for maximum operations. By this arrangement, boiler cleaning can be done while the dredge is operating, thus avoiding the need of laying up for this purpose during the time when dredging can be done or the necessity of Sunday cleaning.

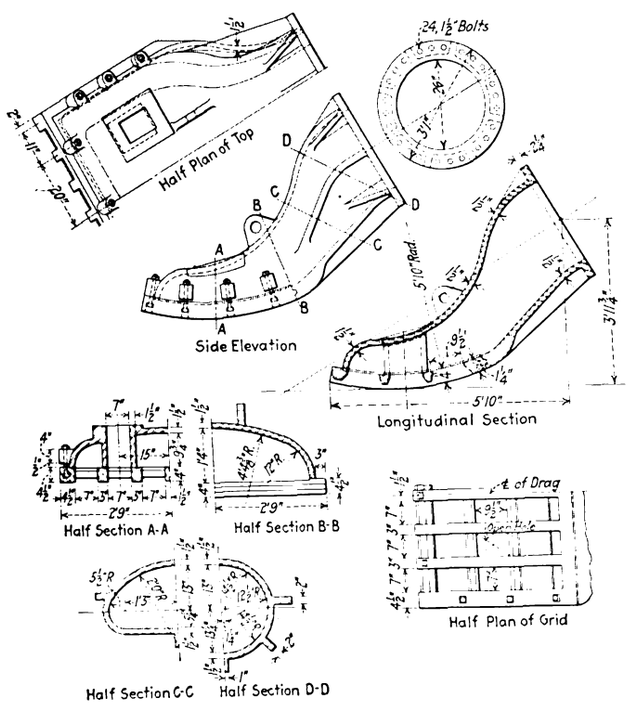
The boilers are placed forward of the hoppers so that their weight will counterbalance that of the machinery and keep the dredge on an even keel with no load or full load.

A passageway has been provided under the hoppers for communication between the engine and boiler rooms. This passageway also provides an additional escape from the fire room.

To compensate for the drop in steam pressure, due to the long steam pipe from the boilers to the engines, and as a source of economy in fuel consumption, steam superheaters have been provided to deliver steam with 50 degrees of superheat at the engines.

While the boilers are to burn oil primarily, provision has been made for changing to coal burning with a minimum of trouble, expense and time.

Induced draft blowers have been provided so that, in the event of coal being used for fuel, sufficient evaporation will be obtained from three boilers, the same as for oil, for maximum operation.



Drag Head Castings

Dredging Machinery

The pumping engine is of the triple expansion type direct connected, through a Kingsbury thrust, to the dredging pump and operates at 145 revolutions per minute.

The dredging pump is of the volute type having a 26-inch suction and discharge.

All bends in the suction and discharge pipes are given as large radii as practicable to reduce friction losses to a minimum.

The drag is of the flat face type with grids to limit the size of dredged material that may enter. The sum of the areas of the openings in the grid is equal to twice the area of cross section of the 26-inch suction pipe.

A water pressure system has been provided for supplying water under pressure to jets in a special drag for dredging in clay or hard packed sand. These water jets agitate or loosen the clay or sand for dredging.

The remarkable record of the *Col. P. S. Michie* has created a great deal of interest in this type of dredge and the Government has received a number of inquiries for detailed information regarding the latest designs from persons who follow up this line of work both here and abroad.

Plan for Cooperation Between Shippers and Shipping Board

Chairman Lasker and Vice-President Love, on March 4, met the committee appointed by the Middle West Merchant Marine Association, representing the chambers of commerce of twenty-five of the largest cities in the Middle West, headed by Malcolm Stewart of the Cincinnati Chamber of Commerce, to receive a report of the committee outlining the best form, in their opinion, of cooperation between shippers in the interior and the United States Shipping Board.

It has long been the desire of Chairman Lasker and Vice-President Love to bring about a closer working understanding between American shipowners and operators on the one hand and exporters throughout the country on the other, and plans had already been laid to this end. The intervening period has been used in order to so improve Shipping Board services as to enable its representatives to offer to exporters of this country services equal to, if not superior, to those maintained by the flags of other nations. In doing this, some eighty lines required consideration.

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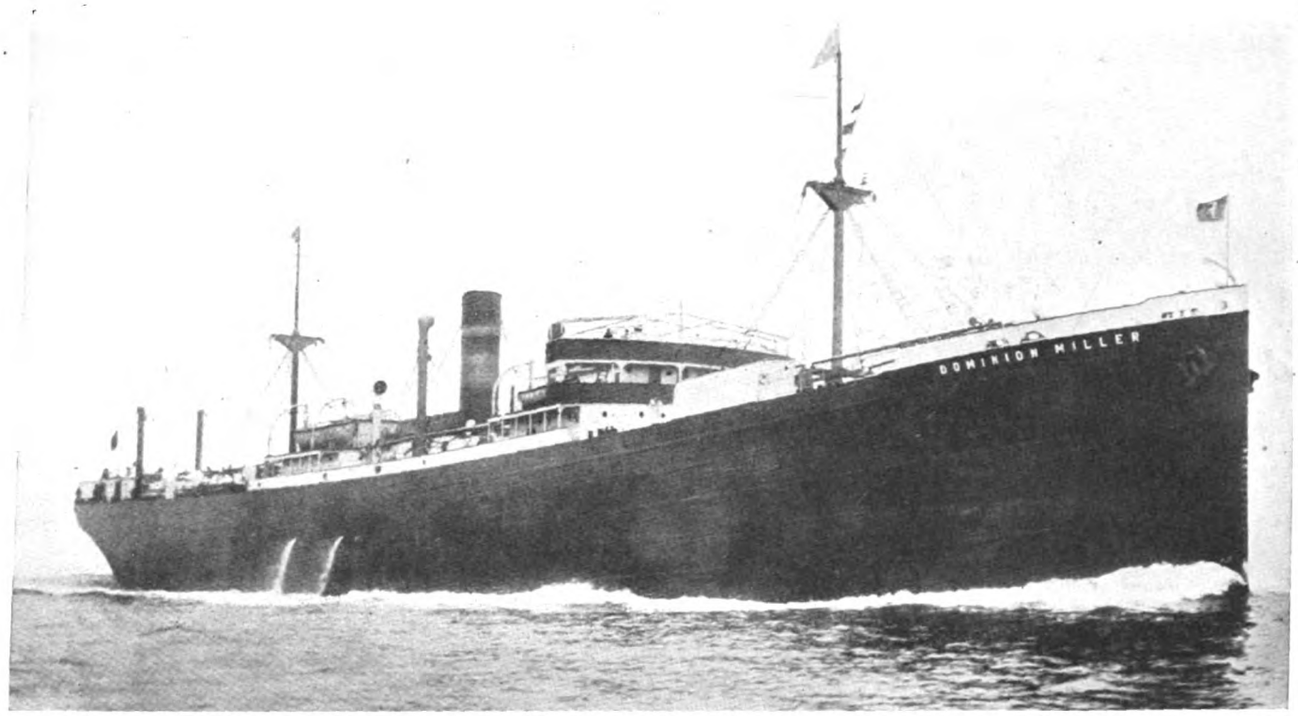

Motorship Dominion Miller, Built for the Furness, Withy Line and Fitted with One 3,000 Horsepower Doxford Oil Engine

3,000 Horsepower Single Screw Motorship

Doxford Engined Vessel of 9,400 Tons Deadweight Built for Furness, Withy and Company—Boiler Oil Proposed as Fuel

By Our Special London Correspondent

AT the end of February, trials were run of one of the most interesting motor vessels that has yet been completed, particularly notable in that it represents the largest type of motorship in which single screw machinery is installed.

With the increasing confidence now felt in the internal combustion plant, shipowners are asking that the normal twin screw arrangement which has been adopted, to a certain extent as a safeguard, should be abandoned and that the cheapness, simplicity, convenience and higher efficiency of single screw craft should now be gained. It is for this reason that some well known oil engine manufacturers such as Burmeister and Wain have developed a special type of Diesel motor suitable for installation in a single screw craft, the main difference from the normal design being that a longer stroke is employed and naturally a lower speed of rotation.

The First Furness, Withy Motorship

The Doxford opposed piston oil engine is intended essentially for single screw ships and incidentally is the highest powered internal combustion marine engine that has ever been built commercially. The vessel which was recently completed, the *Dominion Miller,* built for Furness, Withy and Company, is equipped with one of these Doxford engines and is in many respects similar to the Transatlantic Steamship Company's motorship *Yngaren* which has now been in service for two or three months. Incidentally the *Dominion Miller* is the first vessel built for Furness, Withy and Company and it is understood that this large concern —one of the biggest in Europe—will probably adopt a policy of motorship construction, should the results of this venture prove successful.

There are other features of special interest in this ship both for engineers and shipowners. Controversy rages around the question, whether what is known as boiler oil is suitable for use in internal combustion engines or whether it is desirable that only the higher grade and lighter Diesel fuel should be utilized. Manufacturers of two stroke engines claim that, with the absence of exhaust valves, boiler oil may be employed with complete immunity from trouble but up till the present time no European ship has run more than a few hours on end on boiler oil.

Seven-Day Test of Doxford Engine Using Boiler Oil

In order to satisfy themselves on this point, Doxfords recently ran a trial of 7 days' duration, during the whole of which Mexican boiler oil of a specific gravity of 0.95 was burned. According to the reports that have been published, the results were eminently satisfactory; the fuel consumption was equal to that attained on Diesel oil and, when the engine was opened out, it was in a perfectly clean condition.

On the strength of this, therefore, the owners have decided that after operating for a short time on Diesel oil in order to make quite sure that the engine is mechanically perfect, they will then run the machinery on a mixture of boiler and Diesel oil, and finally use only the former fuel. The experiment will be watched with the greatest interest since in many ports there is a very considerable difference in the price of boiler and Diesel oil, the former in England costing £3.15.0 and the latter £5.15.0 per ton.

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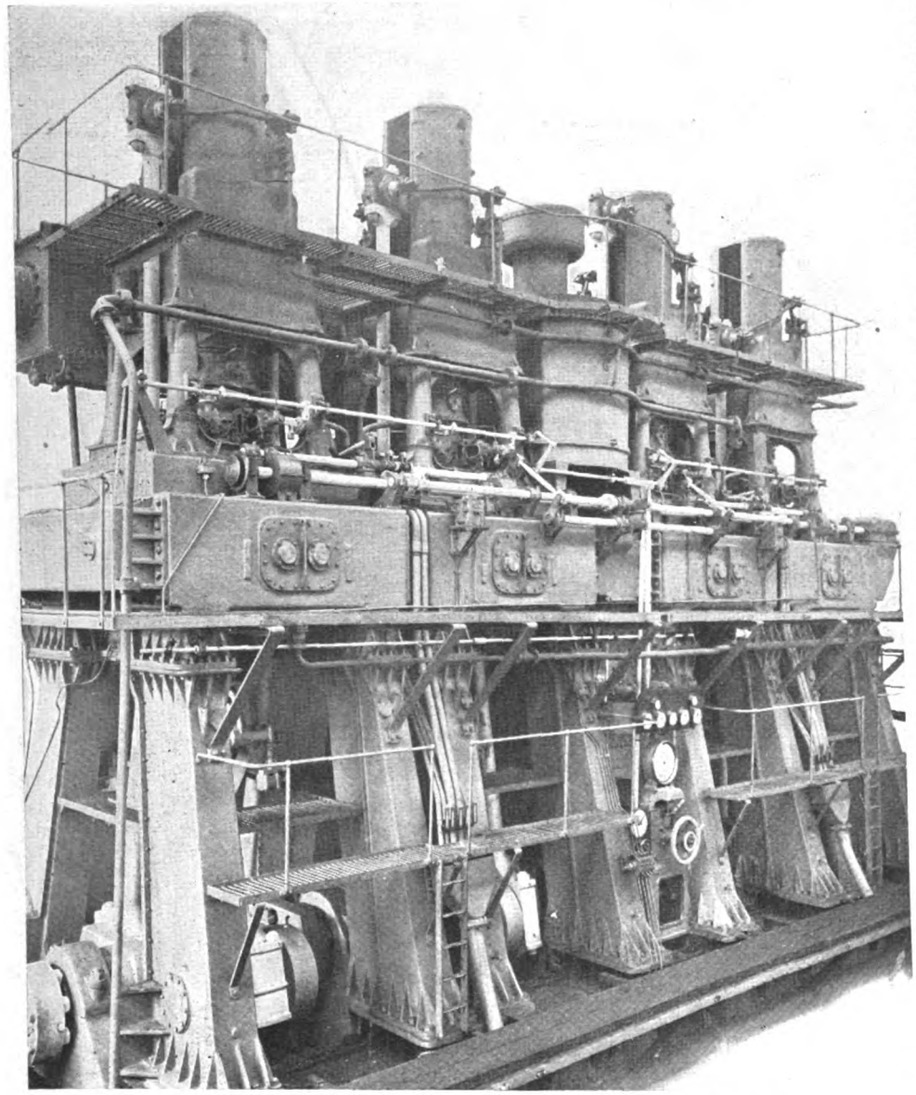

3,000 Indicated Horsepower Doxford Opposed Piston Engine

Details of the Vessel

The new vessel is very similar in hull dimensions to standard steamers which Doxfords have built for several years past. The following are the details and the dimensions:

Length between prependiculars	420 feet
Maximum beam	54 feet
Maximum draft	25 feet 6 inches
Deadweight cargo capacity, tons.....	9,400
Speed, knots	10½ to 11
Indicated horsepower	3,000

No special point of interest attaches to the construction of the hull, as it represents a cargo ship of normal design. The engine room is located slightly aft of amidships and, as for special reasons, all the auxiliary machinery is steam driven, two large boilers are installed in addition to the propelling and auxiliary plant. It is unusual in these days to find a motorship equipped with steam auxiliaries as it has been definitely proved that, in spite of the higher capital costs of an electrical plant, the saving in running expenses is so considerable that the increased expenditure is rapidly repaid.

Unusual Features of the Doxford Engine

The main engine develops its full power of 3,000 indicated horsepower at 77 revolutions per minute, which incidentally is the lowest speed that has yet been adopted in any marine Diesel engine. There are only four cylinders so that the output per cylinder is 750 indicated horsepower and as the brake power of the motor is 2,700, each specific cylinder output is 675 brake horsepower—easily the largest that has yet been attained.

The cylinders are only 580 millimeters diameter, which is much less than that of the biggest Burmeister and Wain eight cylinder 3,200 indicated horsepower engines and gives some indication of the possible advantage of the two stroke type. The stroke of each piston is 1,160 millimeters, giving a total effective stroke of the two opposed pistons combined of 2,330 millimeters.

The principle of the operation of the Doxford opposed piston engine is now fairly well known. The bottom piston drives direct on to a crank on the crankshaft and the crosshead of the upper piston is attached to two vertical rods joined at their bottom ends to connecting rods driving on to cranks, one on each side of the main cranks. There are thus, in all, thirteen cranks, including that driving the scavenging pump, and the difficulty of constructing the crankshaft is perhaps one of the chief points that has been urged against the Doxford engine.

The long stroke of the piston necessitates a liner over 10 feet in length and here again the greatest care in construction has to be exercised since this liner is pierced in the center for the reception of two fuel valves, one at the back and one at the front, in addition to the starting air and relief valves. The liner is ribbed, crosswise and vertically, for about a third of the length at the center and it is held at this point by the cylinder barrels, the remaining portion of the liner being free to expand. The scavenging ports are at the bottom of the liner and the exhaust ports at the top, the only mechanically operated valves being the two fuel valves for each cylinder and the starting air valves.

What is known as solid injection of fuel is employed in this engine, a battery of fuel pumps being driven from the crankshaft supplying fuel to the valves at a pressure of no less than 9,000 pounds per square inch. An auxiliary set of fuel pumps is installed in the engine room and this, like the other plant, is driven by means of a steam engine. Scavenging air is supplied from a vertical scavenging pump driven from the crankshaft and located between the two pairs of cylinders. Fresh water cooling is used throughout, supplied from steam driven circulating pumps, the fresh water being of course itself cooled by the circulation of sea water around it in a special cooler.

Control of the Engine

The control of the engine is simplicity itself and is effected solely by hand without the use of compressed air as is neces-

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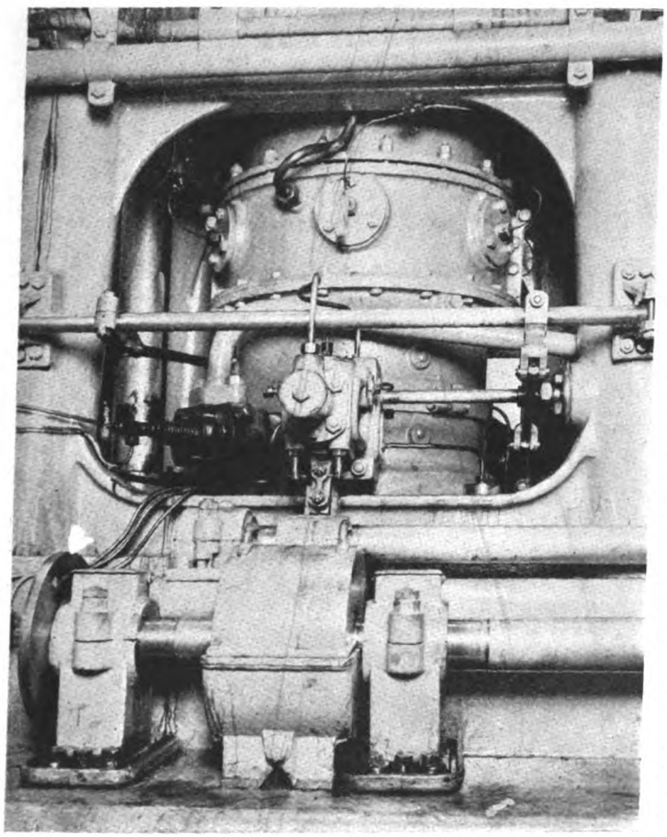

A Close View of One of the Cylinders of the Doxford Engine, Showing a Fuel Valve Through Which the Fuel Is Passed at a Pressure of 9,000 Pounds Per Square Inch

sary on all four cycle engines. A hand lever suffices to move the camshaft fore and aft to bring the astern cam (mounted side by side with the ahead cams on the camshaft) into operation. Starting and maneuvering are then effected by a small hand wheel and the control is much the same as with a steam engine, the hand wheel being gradually turned more and more to increase the speed. Its first action is to cause the levers actuating the starting valves to come on to their cams, thus allowing compressed air to be admitted to the cylinders and to start up the engine. On rotating the starting wheel further, the starting valve levers are taken out of action and those operating the fuel valves come on to their cams when the engine fires in the normal manner. Increased speed is attained by altering the lift of the fuel valves, this being carried out when the control wheel is rotated still further.

Engine Not of Cold Starting Type

One peculiarity of the Doxford engine is that as the compression is low, being no more than 280 pounds per square inch, it will not start up from cold and therefore has to be heated by passing steam through the pistons. This is a process taking about a couple of hours, so that this motor is not of the cold starting type and indeed cannot exactly be termed a Diesel engine at all.

Judging from the performance of the previous vessel with similar machinery, the *Dominion Miller* will have a daily fuel consumption of about 9½ tons for a speed of between 10 and 10½ knots when carrying her full cargo of 9,400 tons. According to Doxfords' experience, this compares with about 45 tons of coal on a corresponding steamer or about 25 tons of oil on a ship equipped with oil-fired boilers. The saving on the fuel bill is therefore on a large scale, particularly if it is found that the engine will operate successfully on boiler oil.

Application of Electricity to Deck and Engine Room Auxiliaries*

By C. H. Giroux†

AS far back as 1900 the battleships *Kearsarge* and *Kentucky* were equipped extensively with electric auxiliaries and since that time this method of drive has been largely adopted by the Navy Department for all classes of ships. In spite of this fact there has been comparatively little progress made along similar lines in our merchant marine.

At the present time when cargo is scarce and competition is keen and when the supply of American vessels exceeds the demand, the shipowner must not overlook even the smallest item entering into the cost of operating vessels, otherwise the business may be a complete failure. A recent analysis of the performance of a large cargo vessel shows a return of 22 percent on the investment for electric auxiliaries. Where else can capital be invested with an equal return?

The problem of those who are advocating the general use of electricity on merchant vessels is first, to prove conclusively that electrical apparatus can be made reliable under marine conditions and then that the economy and low maintenance will warrant the investment of the necessary capital.

At the present time there are six steamships and two Diesel ships in merchant service propelled by electricity, the equipment for which was built by the General Electric Company. These ships, in charge of chief engineers having no previous experience with electrical apparatus, have made many voyages under all kinds of sea conditions and have proven themselves to be thoroughly dependable.

The General Electric Company has had a wonderful opportunity and has taken the trouble to make a thorough study of the operating conditions on many classes of merchant ships and has laid out plans whereby these same ships could save as much as ten or fifteen percent in the fuel consumption by the use of electric auxiliaries and by effecting a proper heat balance.

It is conservatively estimated that on a freight vessel propelled by a 2,500 shaft horsepower geared turbine, operating at sea for 220 days per year, the saving in fuel alone, which could be effected by the use of electrically driven auxiliaries, amounts to at least nine thousand dollars per annum.

The saving when the ship is in port is even greater than when at sea. The port consumption of cargo vessels with steam machinery varies from fifty to one hundred barrels of fuel per day when handling cargo, depending upon the size of the ship and the number of winches in use. These same ships, if equipped with electric engine room and deck auxiliaries, would consume from one-half to one-third of this fuel.

Little emphasis need be placed on the economy of electric auxiliaries when used with motorships for here the results are so remarkable that there is no basis of argument. I have extracts from the logs from two motorships, each driven by two 500 brake horsepower Diesel engines, one equipped with steam and the other with electric auxiliaries.

The donkey boiler for feeding the steam auxiliaries required an average of 557 gallons of oil per day at sea as compared with 42.5 gallons taken by the auxiliary engine for driving the electric motors.

On the motorship *Kennicott*, where electricity is used for all auxiliary purposes, the port consumption when loading or discharging cargo for ten hours is less than five barrels of fuel per day. This shows the possibilities where electricity is used for power.

*Extracts from a paper read before the Ocean Marine Engineers Beneficial Association, No 80, New York.

†Marine Engineering Department, General Electric Company, Schenectady, N. Y.

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Diesel-Engined Derrick Lighter Worthington

Vessel for Service in New York Harbor Equipped With New Type of Two-Cycle Solid Injection Worthington Diesel Engine

A NEW departure in the application of Diesel propelling and auxiliary machinery is found in the recent completion by the Vinyard Shipbuilding Company at Milford, Del., from designs prepared by Eads Johnson, naval architect, New York, of the self-propelled single screw Diesel engine-driven derrick lighter *Worthington,* built to the order of the Worthington Pump and Machinery Corporation, New York, to take the place of their steam derrick *Daniel Wheeler,* used for handling the company's products

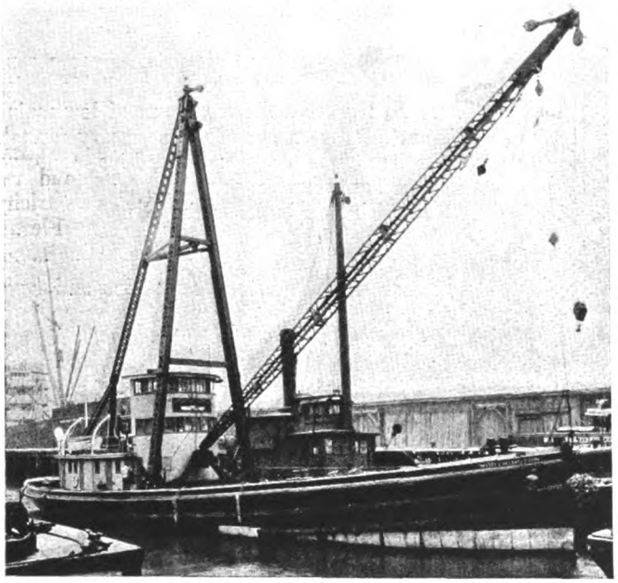

Fig. 1.—Derrick Lighter Worthington, Showing Arrangement of 20-Ton "A" Frame Derrick. Steam Lighter Daniel Wheeler in Background

in New York harbor and vicinity. Both the new and the old lighters are shown in Fig. 1.

In preparing the designs for this vessel, the naval architect collaborated with the Worthington company's engineers with a view towards achieving the most successful adaptation of this new type of power equipment to the special conditions of the service in which the boat is to be engaged. The derrick was built and installed by the Terry Manufacturing Company, New York.

The outstanding feature of this new lighter, aside from her size and the completeness of her equipment and accommodations, is the installation of a new type of Diesel engine, developed by the Worthington Pump and Machinery Corporation, for propelling the vessel and also for driving its main generator which supplies the current for the derrick motor, auxiliaries and electric lights. This engine is a two-cycle solid injection Diesel designed with a view to simplicity of construction and reliability of operation. As its weight per horsepower is about half that of the ordinary Diesel and its economy comparable with that of the ordinary Diesel, its simplicity and reliability of operation will appeal to marine engineers.

The hull of the *Worthington* is of wood, 133 feet long with a beam of 35 feet and a load draft of 10 feet. The gross tonnage is 333, the net tonnage 225. The hull is of unusually heavy construction to withstand the hard usage incident to service around the docks and harbor shipping and is full bodied in order to provide the necessary stability for operating the cargo derrick at long radii.

Derrick Equipment

An "A" frame derrick of 20 tons lifting capacity, of steel lattice work construction, is mounted abaft the midship line with a back leg extending to within a few feet of the stern. About 15 feet above the deck this back leg is divided into a fish tail, the two parts spreading out to within five feet of the rail on each side. The top of the "A" frame stands 70 feet above the main deck line. The derrick boom is 90 feet long and is stepped on a tripod base seven feet above the main deck. This construction permits the lighter to lie alongside high sided ships and handle cargo on deck or in the holds without using the ship's own cargo booms.

The derrick is mounted on foundations built up on fore and aft and athwartship trusses under the main deck and in the vicinity of the trusses and spaces between the frames and between the deck beams are filled in solid with timbers. Large U-bolts hold the derrick legs down and pass through the trusses to the hull framing so that all the stresses from the derrick are carried right to the bottom of the hull.

In a compartment just forward of the engine room is located the hoisting engine for operating the derrick. This is a five drum machine driven by a 25 horsepower General Electric motor and built by the National Hoisting Engine Company. The wire cable from each drum is led by means of suitable pulleys to a point directly beneath the derrick, then up through the deck to its proper place on the derrick. By means of reach rods and bell cranks the controls for all drums are operated by a bank of levers located in a glass enclosed operating room directly beneath the pilot house. A controller of the trolley car type for controlling the hoisting engine motor is also located in this room.

General Arrangement

In the space between the derrick "A" frame and the back leg is located the deck house containing living quarters for the crew, the operating room for controlling the derrick and the pilot house. From the "A" frame to the stem of the boat is clear deck space for cargo stowage. On boats of this type it is customary to carry all cargo on deck but on this vessel a large main deck hatch is provided so that perishable freight can be stowed in the hold, if it should be necessary to keep it on board for any great length of time.

At the level of the main deck in the deck house are two single and two double staterooms, one for the chief engineer, one for the assistant engineer, one for a deckhand and the cook and one for two deck hands. At the after end of the deck house on the port side is the galley, opening into the messroom on the starboard side. On the second deck in the deck house are two staterooms, one for the captain and one for the mate. On the same level and just forward of these two staterooms is the derrick operating room. Above the operating room is the pilot house, handsomely finished in hardwood. The appointments and finish of all the living quarters are somewhat above the average practice in harbor work boats.

The engine room is located in the stern and contains the main propelling engine, the electric plant for supplying cur-

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rent to the derrick motor, auxiliaries and electric lights, an emergency lighting set, auxiliary air compressor, auxiliary lubricating oil circulating pump, auxiliary cooling water circulating pump, oil cooler, hot water heating boiler and starting air tanks.

PROPELLING MACHINERY

The main engine is a Worthington two cycle, solid injection, four cylinder Diesel engine, with cylinders 15¼ inches diameter by 16 inches stroke, developing 300 brake horsepower at 275 revolutions per minute. All of the control gear and fuel pumps are included in a sub-assembly at the forward end of the engine. On the after end, just abaft the

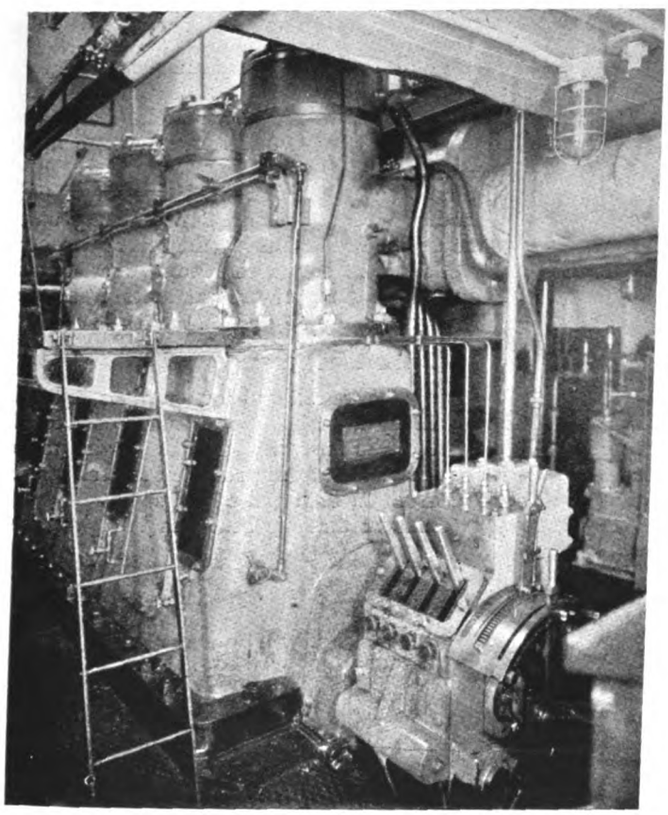

Fig. 2.—Starboard Side, Looking Aft, of 300 Horsepower Worthington Diesel Propelling Engine, Showing Control Assembly. All Operations Are Controlled from This Point

flywheel is another sub-assembly consisting of a lubricating oil circulating pump, cooling water circulating pump, starting air compressor and mechanical cylinder lubricators, all driven from one eccentric. Attached to the aft end of the engine bed is a S. K. F. ball thrust bearing.

On the starboard side, forward is the electric generating plant consisting of a Worthington two cycle, solid injection, two cylinder, Diesel engine of 50 horsepower direct connected to a General Electric 38 kilowatt, direct current generator delivering current at 220 volts. A cooling water circulating pump, a bilge pump and a lubricating oil circulating pump are attached to this engine. This set supplies current for operating the derrick engine, the auxiliary air compressor, auxiliary pump and electric lights.

AUXILIARIES

For pumping up starting air when the main engine compressor is not in operation, a Blake & Knowles (manufactured by the Worthington Company), two stage, motor driven compressor is provided. This compressor is provided with a Cutler Hammer automatic starter which can be set to maintain the air in the starting air reservoirs at any desired pressure, a combined pressure gage and electric switch making contact and closing the starting circuit to the air compressor motor when the air pressure in the tanks falls to the desired minimum and breaking contact when full pressure is reached. As long as the main attached compressor keeps the pressure in the starting air tanks between 250 and 350 pounds the auxiliary compressor does not operate but if engine maneuvers are made so frequently that the attached compressor cannot keep up the supply and the pressure falls to 250 pounds the starter gage closes the circuit, the auxiliary compressor starts without attention from the engineer and keeps running until the air pressure reaches 350 pounds,

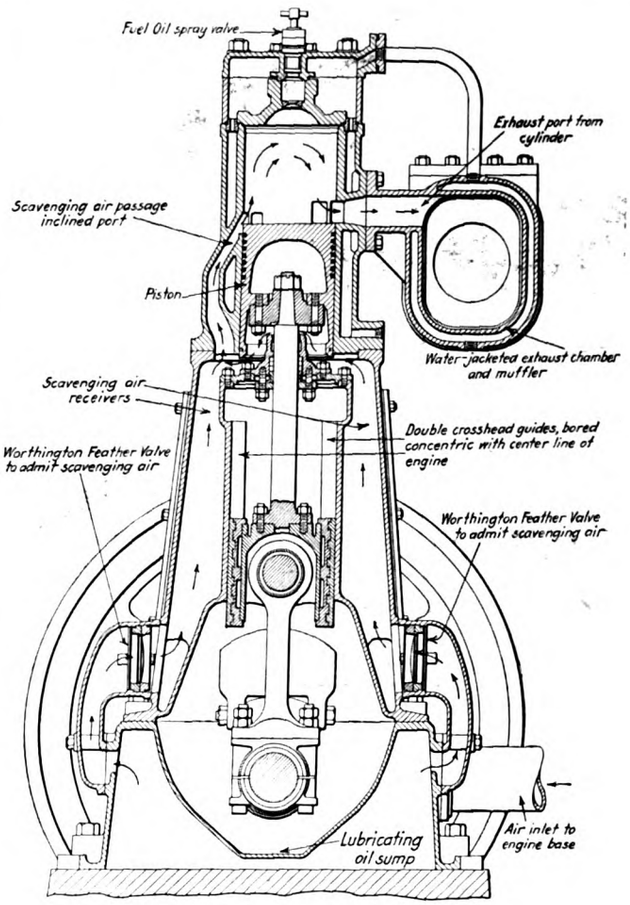
Fuel Oil spray valve
Exhaust port from cylinder
Scavenging air passage inclined port
Piston
Water-jacketed exhaust chamber and muffler
Scavenging air receivers
Double crosshead guides, bored concentric with center line of engine
Worthington Feather Valve to admit scavenging air
Worthington Feather Valve to admit scavenging air
Lubricating oil sump
Air inlet to engine base

Fig. 3.—Section Through Engine

when the starter gage opens the circuit and the auxiliary compressor stops.

For emergency use, if the lubricating oil pump on either the main or auxiliary engine stops working, a motor driven rotary oil pump is provided. For emergency cooling water circulation a Worthington 2-inch volute, centrifugal, motor driven pump is provided. This pump has a connection to the bilge and can also be used to supply water to the fire hydrants on deck.

A Griscom-Russell vertical oil cooler is located in a very accessible position on the port side of the main engine and is so connected that it may be used to cool the bearing lubricating oil or in cold weather, if the oil is too stiff for proper circulation, the hot jacket water from the engine may be circulated through the cooler and the oil heated.

ELECTRIC PLANT

For supplying current for lighting the boat or operating any of the auxiliary pumps when the 50 horsepower auxiliary set is shut down a Cummins oil engine of 7 horsepower is

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provided, connected to a 6 kilowatt Triumph, direct current generator. This engine operates on the Hvid principle, burns the same fuel as the main engine and can be started by hand. If for any reason all the starting air should be lost, so that the 50 horsepower auxiliary engine cannot be started, this small set can be started by hand and will supply power enough to operate the auxiliary air compressor and pump up the starting air.

Starting air at 350 pounds pressure is stored in six cylindrical tanks of about 20 cubic feet capacity each, located in the extreme aft end of the engine room. This greatly exceeds the air requirements for the engine but the owners of the boat wished to be on the safe side and insure the boat against loss of maneuvering power in situations where very complicated maneuvers are required around crowded docks or among harbor shipping. In service it has been found that for normal operation two of these tanks are ample to meet the requirements.

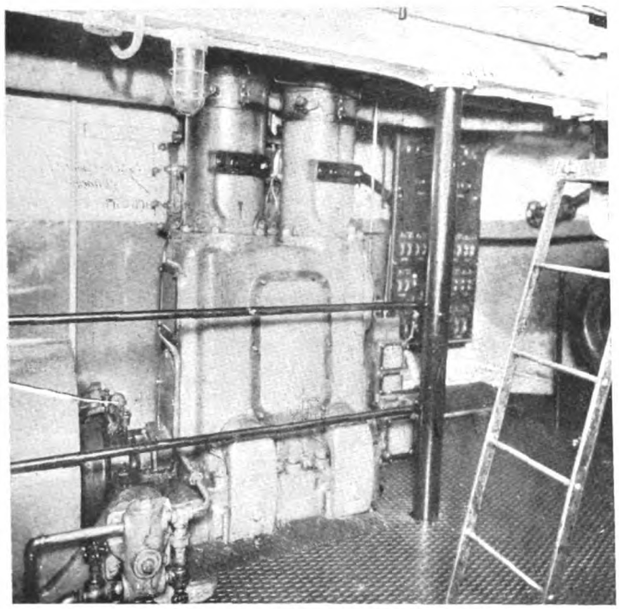

Fig. 4.—Worthington 50 Horsepower Diesel Engine Connected to 38 Kilowatt Generator for Supplying Current for Operating Derrick and All Auxiliaries. Switchboard in Background

New Type of Air Whistle Installed

Air at 100 pounds pressure for operating the whistle is stored in a tank that is a duplicate of the starting air tanks. Air is supplied to it through a reducing valve from the starting air reservoir. This tank was made of the same strength as the starting air tanks as a safety precaution in case the reducing valve should get out of order and permit full pressure of air to enter the tank.

In place of the conventional type of air whistle, which is notoriously ineffective as a sound producer and very extravagant in its use of air, the *Worthington* carries on top of the pilot house a Strombos duplex sound signal. This is a most effective sound device producing a very pleasing organ note, audible over long distances and requiring so little air that it is operated from a ¼-inch pipe.

The fuel supply is carried in two cylindrical steel tanks, of 4 tons capacity each, located outboard, one on each side in the hoisting engine compartment just forward of the engine room. At the main deck level in the engine room entrance, just above the main engine are located two daily service tanks each of sufficient capacity to operate the main engine continuously for six hours. A small pump driven from the crankshaft of the 50 horsepower engine transfers oil from the main tanks to the service tanks and a hand operated oil pump is provided as a standby. On the port side just forward of the fuel tank is a fresh water storage tank, while in a corresponding position on the starboard side is the lubricating oil storage tank.

Fire Fighting Equipment

In addition to the usual fire fighting equipment required by law additional protection against oil fires is provided in the form of a Foamite Firefoam engine of 80 gallons capacity installed in the forward part of the engine room hatch with sufficient hose attached to reach any part of the boat. In case of fire this machine is put into operation simply by opening one valve and the 80 gallons of mixture will produce 700 gallons of fire smothering foam under sufficient pressure to project it 50 feet from the hose nozzle. So effective is this apparatus for fighting oil fires that a very material reduction in insurance rate is granted by the underwriters where it is installed.

For heating the boat an Arcola hot water system of the ordinary house heating type is installed, the heating unit being located in the engine room. During the severe weather of the past winter this system proved so effective that it was found necessary to remove some of the radiators from the living quarters to reduce the heating effect.

Deck Machinery

For use in warping the vessel, pulling on lines, etc., a warping winch, driven by a 10 horsepower motor is located inside the deck house in the forward end of the engine room hatch, with a through shaft extending outside the deck house on each side and a drum on each end of the shaft.

It is worthy of comment that the boat was brought from the builders' yard to deep water in Delaware Bay through the shallow and tortuous water of Missapillion Creek under its own power, a trip requiring six days of almost constant maneuvering with the main engine. During this time the engine, although new and not "run in," met all the requirements of rapidly repeated maneuvers in a completely satisfactory manner, after which the vessel completed a sea trip in severe winter weather to New York without the slightest interruption.

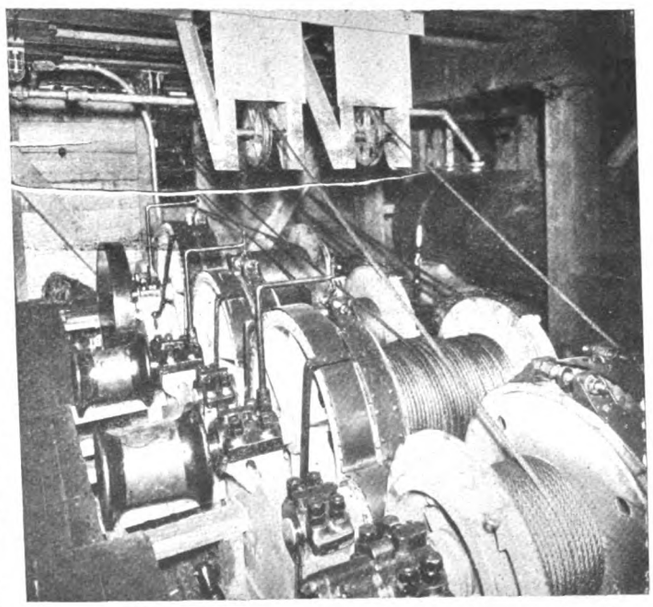

Fig. 5.—Electric Motor Operated Hoisting Engine for Controlling All Derrick Operations

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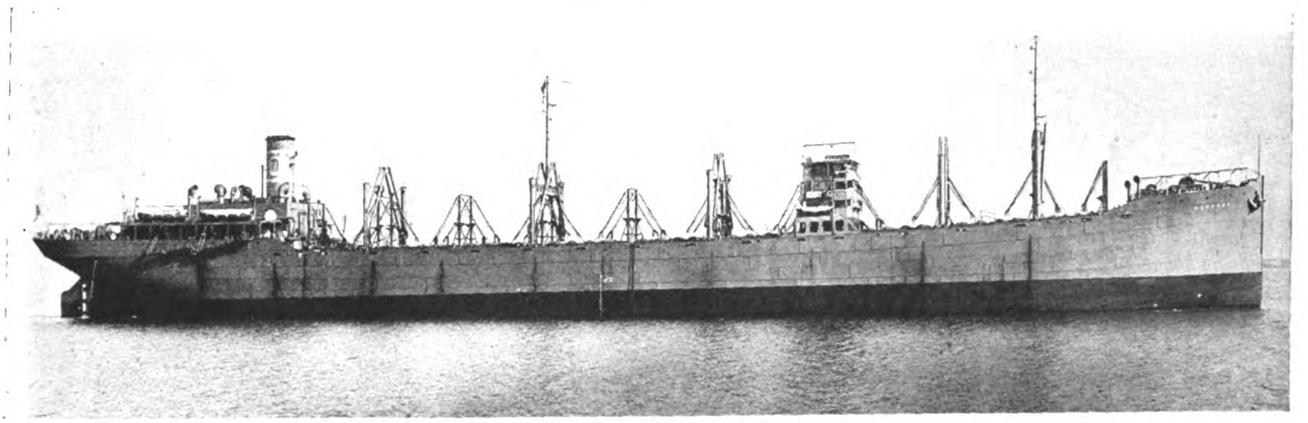


Combined Ore and Oil Carrier Bethore, of 20,500 Tons Deadweight, Just Completed at Sparrow's Point (Md.) Plant of Bethlehem Shipbuilding Corporation, Ltd.

STEAMSHIP BETHORE COMPLETED

20,500-Ton Combination Ore and Oil Vessel Built by Bethlehem Shipbuilding Corp., Ltd.

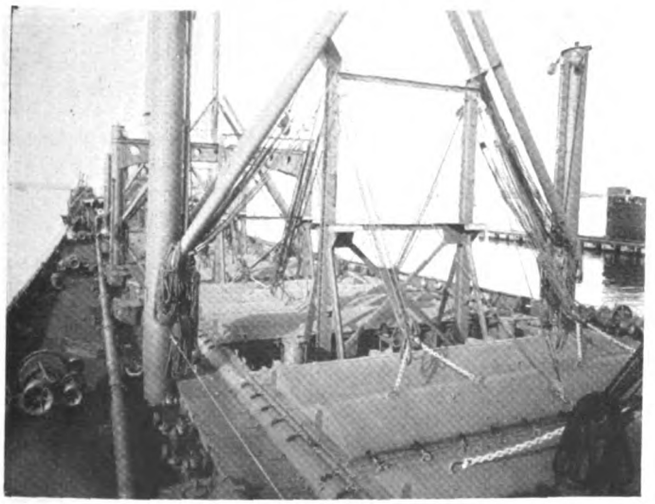
THE S. S. *Bethore* delivered to the Ore Steamship Corporation on February 11, 1922, at the Sparrow's Point, Md., plant of the Bethlehem Shipbuilding Corporation, Ltd., is the second of the large combination ore and oil vessels to be completed at that plant. The first was the *G. Harrison Smith,* delivered to the International Petroleum Company on September 12, 1921.

The commissioning of these steamers inaugurates the entry into service of a new type of vessel that has been developed to meet an economic demand in the construction of oil carriers. The *Bethore* is arranged with separate cargo spaces so designed and located that either a full load of oil or a full load of ore can be carried, or general cargo equal to approximately from one-half to one-third the deadweight capacity, according to density, can be carried. The utility of this type of vessel is apparent when it is recognized that it provides means for making a profitable return voyage after a cargo of oil has been delivered, thus enabling the ship owner to obtain 100 percent service from his fleet.

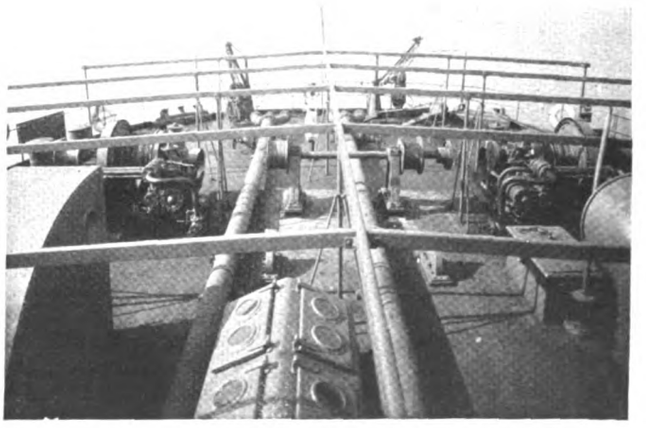
The ordinary tanker, as developed to date, is especially efficient in handling and transporting oil cargoes, yet suffers from the necessity of return voyages made in ballast. This condition means an economic loss which has been accepted as a necessary part of the industry. The advent of the combination ore and oil vessel, however, changes this situation and makes possible a greater return on the investment. Shipowners and operators are thoroughly aware of the necessity for economical operation and the importance of keeping their fleet moving with cargoes during the greatest possible number of days in the year, especially with present operating costs. That the construction of combination vessels is not necessarily confined to oil carriers, but may be applied as well to other types of freighters, is evidenced by the construction of two combination coal and ore carriers now building at the Union Plant, San Francisco, of the Bethlehem Corporation.

The *Bethore* is the first combination ore and oil vessel under American registry and ranks as one of the largest of all freight vessels afloat. There are undeniable economies and advantages in the use of vessels of great carrying capacity when conditions in their trade routes allow their use. This is true in the case of the *Bethore,* where the dimensions have been limited only by the depth of water available at loading and discharging terminals.

In design, the *Bethore* is of the patent combination ore and oil type and is similar, with some exceptions, to the *Marore* and *Steelore* now under construction at the Sparrow's Point plant and described in the April, 1921, issue of this paper. She was designed specially for carrying a cargo of oil from Mexico to South America, where the oil is to be discharged and a cargo of ore taken on for the United States,



Looking Aft from Bridge Deck, Showing 12-Inch Oil Cargo Discharge Line and Ore Hold Hatch Covers



Looking Aft on Poop Deck, Showing Two 12-Inch Stern Oil Cargo Discharge Lines

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thus eliminating the necessity of making the return voyage under ballast as usually made by the ordinary tanker. General cargo can be carried on the trip to Mexico.

The general dimensions of the *Bethore* are in brief as follows: Length overall, 572 feet; length between perpendiculars, 550 feet; breadth, molded, 72 feet; molded depth, 44 feet; deadweight capacity, 20,500 tons, and displacement, 29,967 tons. Loaded, the draft is 32 feet 4⅛ inches, and light, the draft is 11 feet 3½ inches. The framing is longitudinal and the vessel is classed to the highest rating of the American Bureau of Shipping and British Corporation.

The principal cargo spaces in the *Bethore* consist of the cargo oil tanks and fuel oil tanks and the ore holds. The latter occupy a space 30 feet wide by 30 feet deep for a distance of 360 feet through the hull of the vessel, and are elevated 14 feet above the keel, which feature constitutes one of the inherent advantages of this type of ore carrying vessel. This ore space is divided by watertight bulkheads into three compartments. The oil cargo space contains 741,294 cubic feet, the fuel oil space, 141,160 cubic feet, and the ore cargo space of the three holds, 367,120 cubic feet.

The forward ore cargo hold is served by two hatches 30 feet long and one 19 feet long. The middle hold is served by three 30-foot hatches, while the after hold is served by two 30-foot and one 25-foot hatch. All hatches are 30 feet wide, the full width of the ore hold, and are of the corrugated patent Hogg-Carr type. Ten kingposts, with eighteen 36-foot Oregon pine booms of three tons capacity are provided for the handling of ore or general cargo in case the ship engages in a trade not having terminal facilities for loading and unloading. The ten 8¼ by 10-inch winches which handle the tackle for raising the hatch covers are available for working the ¾-inch diameter wire rope whips on the cargo booms.

The loading and unloading of an oil cargo is similar to the operations of an ordinary tanker.

In unloading ore, two 15-ton grab bucket unloaders will unload the vessel in about 40 hours.

The main engines in the *Bethore* are Bethlehem triple expansion reciprocating engines with 25-inch, 41-inch and 68-inch diameter cylinders and a 48-inch stroke. Steam is supplied by three Scotch boilers, 17 feet 6 inches in diameter by 12 feet long, built at the Sparrow's Point plant, fitted with Howden's system of forced draft and with the Bethlehem-Dahl mechanical oil burning system. In general both the engine room and deck auxiliaries, including the pumps, steering gear and mooring winches, were built by the Bethlehem Shipbuilding Corporation.

On her trial trips, on February 7 and 8, the *Bethore* more than met her requirements for speed. This vessel was designed for a speed of 11½ knots and over a measured mile off Kent Island developed a speed of 12.125 knots. A mean indicated horsepower of 5,557 was developed at 86.5 revolutions per minute.

National Merchant Marine Association Convenes

(*Continued from page* 228)

were not willing to remain at the mercy of foreign steamship lines but that our steamship operators must consent to be regulated and see their obligations to the shipper clearly defined.

Admiral Benson Given Ovation

Three lusty cheers and loud applause were given to Admiral Benson, a patriot and a fighter, who, after making an enviable reputation in the Navy, and, notwithstanding the fact that he was entitled to retirement from active service, was not afraid to handle the Shipping Board and its great problems practically alone in the face of acrimonious criticism.

The Admiral responded with a few words of explanation of the difficulties that he had labored under without the support of a full board before Mr. Harding's election and he also spoke of the necessity that he felt against doing anything to embarrass the incoming administration.

Mr. Franklin, president of the International Mercantile Marine Company, made a few extemporaneous remarks. He said that the President's message was excellent and exceedingly interesting even to people not in shipping. He hoped that all marine organizations would get behind the Shipping Bill as there was nothing so important for our merchant marine as this legislation.

Mr. Franklin said that it had a far better chance of passing than any previous bill and that, for the first time, support for such a measure could be obtained from the country at large.

Importance of Tramp Ships

Mr. Charles H. Potter, president of the United States Ship Operators' Association, stated that the Shipping Board selected its operating agents from owning and non-owning companies but that he hoped that before another year rolled around all these operators would then be classed as owners. Referring to the operation of tramp vessels by other countries he said in part:

"It is the policy of the Shipping Board to encourage and aid in the development of fast passenger, mail and cargo liners, also berth operations—and rightly so—for the very good reason that the Jones Bill so requires; but why, I ask, should the Shipping Board entirely and absolutely ignore tramp operations? I anticipate the reply will be to the effect that tramp operations are unprofitable—so are the operations of the combination passenger and cargo lines; also regular berth operations with possibly one or two exceptions. I submit that tramp operation is vital and therefore necessary to the ultimate success of a merchant marine. It is reported that since January 1, 1922, 242 foreign tramp steamers and only 51 American steamers have been chartered to transport bulk cargoes, principally from Atlantic United States ports and West Indian ports. These figures should be convincing evidence that foreign competitors are on the job; that they are taking advantage of our inactivities and short-sighted policy; and unless Government aid (either through an appropriation or subsidy) is forthcoming, and, I might add, revision of our antiquated and hampering navigation laws effected, we cannot hope to attain the goal to which we as a nation should aspire.

"The success of the British merchant marine is undoubtedly due to the large number of tramp owners rather than to the larger companies or combinations. Before the war the British fleet was divided about 60 percent tramp—40 percent liners. In recent years the larger companies or lines have deemed it necessary to buy tramp fleets in order that they might utilize these tramp vessels in supplementing the line ships on a berth controlled by conference. The tramps are not under conference regulations, and evasion of the conference rules was obtained by using uncontrolled tramps in a supplementary service. The Scandinavian countries, who have been most successful in shipping, have been principally tramp owners. Japan has also encouraged and developed its tramp tonnage. France and Italy have been principally owners of line vessels and their success has been very limited."

At the conclusion of the convention the delegates were received at the White House by the President. The President expressed his gratification at the assistance which the members of the Association had been able to render in studying the problems of marine legislation as applied to shipping.

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Twisting Moments of Reciprocating Engines

Determination by Graphical Method and Use of Mathematical Formulae—Application of the Formulae

By Joseph Hecking*

THE laying-out of the twisting moment diagrams for reciprocating engines requires time and care. The work is considerably facilitated by the use of the graphical method, wherein the twisting moment at any crank angle equals the piston load at this angle multiplied by the distance between the center of the shaft and the intersection of the connecting rod with the horizontal centerline of the shaft, noted as "a" in the figures.

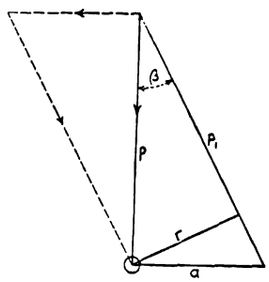

Fig. 1

The mathematical formula for the graphical method is the following:

In accordance with the triangle of forces (Fig. 1).

$$P_1 = \frac{P}{\cos \beta}$$

where P = piston load, P_1 = force in the direction of the connecting rod. According to the law of similar triangles we have:

$$\frac{P_1}{a} = \frac{P}{r}$$

$$a \times P = P_1 \times r$$

The piston pressure to be taken from the indicator card at a point corresponding to the relative position of piston to crank. The inertia pressure per square inch of piston area at the various positions of the piston must be considered in the value of "p" and may be calculated for each engine or an average value may be assumed, depending on the type of the engine. It should be remembered that inertia is to be deducted from the working pressure for the first half of the stroke and to be added for the second half.

Torque Arm

Unless the torque diagrams are laid down accurately and to a large scale, errors are apt to occur in measuring values. The results of the graphical method may be readily determined mathematically without the construction of a diagram. The dimension "a" representing the leverage of the turning force may be determined as follows (see Fig. 2):

R = ratio of connecting rod length to crank length
m = sin α × r
n = cos α × r

$$\sin \beta = \frac{m}{Rr} = \frac{\sin \alpha \times r}{Rr} = \frac{\sin \alpha}{R}$$

$$s = \tan \beta \times n = \tan \beta \times \cos \alpha \times r$$

For upper half of stroke:

$$a = m + s = (\sin \alpha \times r) + (\tan \beta \times \cos \alpha \times r)$$

For lower half of stroke:

$$a = m - s = (\sin \alpha \times r) - (\tan \beta \times \cos \alpha \times r)$$

Piston Position

When the crank pin has traveled to the position of angle α the piston has moved through the distance "b," and the pressure of the lower position is measured from the indicator card. The length of the indicator card is taken as 2 r. The distance "b" is determined as follows:

$$t = \cos \beta \times R\, r$$

Upper half of stroke:

$$b = (R+1)\, r - t - n$$
$$b = (R+1)\, r - (\cos \beta \times R\, r) - (\cos \alpha \times r)$$

Lower half of stroke:

$$b = (R+1)\, r - t + n$$
$$b = (R+1)\, r - (\cos \beta \times R\, r) + (\cos \alpha \times r).$$

The values of "a" and "b" have been calculated by the above formulae for each 10 degrees of the crank and are tabulated in Table I on the next page.

*Engineer Surveyor, Scientific Department, American Bureau of Shipping, New York.

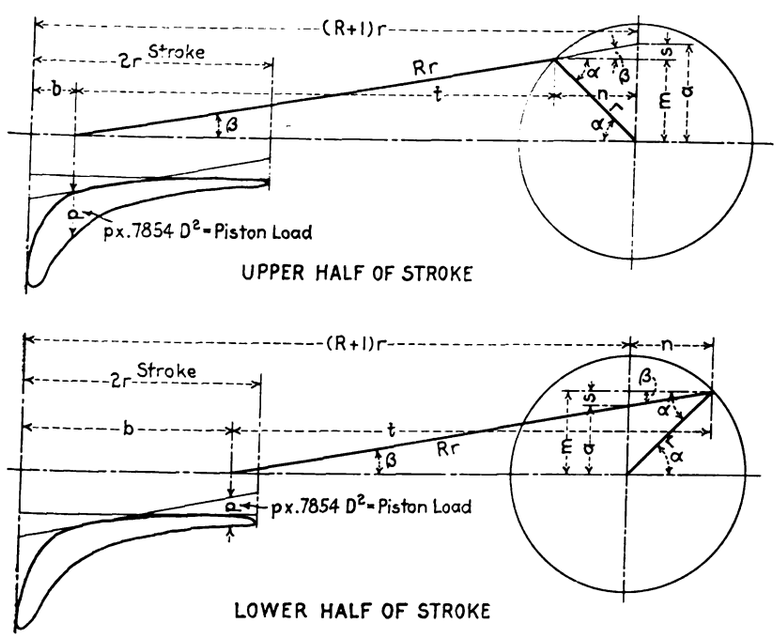

Fig. 2

Example: The indicator cards shown in the figures are taken with a 375 pound spring from a 4 cycle Diesel engine 24-inch diameter, 36-inch stroke, i. e., 1 inch height of the pressure curve represents 375 pounds pressure. The length of the connecting rod is 4½ times the length of the crank, R = 4.5.

For the 40-degree position of the crank the relative position of the piston, according to the table, b = .2803 × 18 inches = 5.05 inches from the upper position. Length of card 2r = 36 inches.

The piston pressure at this point is $\frac{19}{32} \times 375 = 223$ pounds and the piston load 223 × .7854 × 24^2 = 100,800 pounds.

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Table I—Values of "a" and "b" for Each 10 Degrees of the Crank

Crank angle from upper position	Ratio of connecting rod to crank lengths: 4 a	4 b	4.5 a	4.5 b	5 a	5 b	5.5 a	5.5 b
0	0	0	0	0	0	0	0	0
10	.2164	.0188	.2117	.0183	.2078	.0182	.2048	.0179
20	.4223	.0751	.4137	.0734	.4063	.0723	.4006	.0708
30	.609	.1652	.5965	.1619	.5866	.159	.579	.1566
40	.7673	.286	.7533	.2803	.7423	.2755	.725	.2714
50	.8892	.4312	.875	.4224	.8642	.4162	.855	.41
60	.9767	.5948	.9641	.5841	.9539	.5755	.9457	.5682
70	1.022	.77	1.013	.7575	1.005	.747	.999	.7389
80	1.029	.9488	1.024	.9358	1.02	.9244	1.016	.9155
90	1	1.127	1	1.113	1	1.101	1	1.092
100	.9406	1.296	.9458	1.283	.95	1.272	.9532	1.263
110	.857	1.454	.8667	1.442	.8743	1.431	.8804	1.423
120	.7553	1.595	.7679	1.584	.7781	1.576	.7863	1.568
130	.6428	1.717	.657	1.708	.6678	1.702	.677	1.696
140	.5183	1.818	.5323	1.812	.5433	1.808	.5606	1.803
150	.391	1.897	.4035	1.894	.4134	1.891	.421	1.889
160	.2617	1.955	.2703	1.953	.2777	1.952	.2834	1.95
170	.1308	1.988	.1355	1.988	.1394	1.988	.1424	1.988
180	0	2	0	2	0	2	0	2

Values of "a" and "b" to be multiplied by "r."

Turning arm "a" = .7533 × r = 13.56 inches.
Twisting moment = 100,800 × 13.56 = 1,365,000-inch-pounds.

For angles different from those given in the table the *formulae* should be used to obtain the corresponding values of "a" and "b." For different ratios of connecting rod to crank lengths it will be sufficiently correct to interpolate between values given in the table.

Application of Formulae

In multi-cylinder *Diesel engines* the crank shaft at the after crank transmits the combined torque of all the cylinders and is, in addition, subject to bending strains. (See "Diesel Engine Crank Shafts" in Marine Engineering and Shipping Age, February, 1921.) The line shafts are subject to twisting strains only, disregarding bending strains due to their own weight, and the moment of resistance (Section modulus × working stress) should not be less than T maximum found by the above formula, i. e., $0.196\ d^3 f = T$ maximum. The position of the crank angle for T maximum will be found near the 30-degree position for all engines excepting the 4-cylinder 4-cycle, where it is located near the 110-degree position. T maximum is therefore the sum of the twisting moments of one crank at the 30-degree position plus the twisting moments of all other cranks at their position in relation to the 30-degree angle. Similarly for the 4-cylinder 4-cycle engine as mentioned above. Diesel engines are usually fitted with flywheels which have the effect of equalizing the turning effort, thus reducing T maximum and increasing T minimum for the shafting aft the flywheel. It is not advisable to take full advantage of the reduction in T maximum but rather to calculate line shafts with a somewhat higher fibre stress "f" of 7,500 to 8,000 pounds per square inch.

In *turbines and motors* the turning effort is uniform and T mean = T maximum; the working stress "f" is usually taken at 5,000 pounds per square inch.

$$T\ m = \frac{S.\ H.\ P. \times 63{,}000}{R.\ P.\ M.} = 0.196\ d^3 \times 5{,}000$$

$$d^3 = \frac{S.\ H.\ P. \times 63{,}000}{R.\ P.\ M. \times 0.196 \times 5{,}000} = \frac{S.\ H.\ P. \times 65}{R.\ P.\ M.}$$

Steam Reciprocating Engines

Years of experience and common practice have established certain constants which may be used safely in calculating shaft diameters. T m is found by the well known formulae

$$\frac{plan}{33{,}000} = \frac{T\ m \times 6.28 \times R}{12 \times 33{,}000}$$

$$\text{or } \frac{p\ S\ D^2 R}{252{,}000} = \frac{T\ m \times R}{63{,}000}$$

$T\ m = .25\ p\ S\ D^2$ where

p = mean referred pressure
S = stroke in inches
D = diameter of low pressure cylinder in inches
R = revolutions per minute

$$\text{For compound engines } \frac{T\ max.}{T\ m} = 1.45$$

$$\text{and } T\ max. = 0.363\ p\ S\ D^2$$

$$\text{For triple expansion engines } \frac{T\ max.}{T\ m} = 1.33$$

$$\text{and } T\ max. = 0.333\ p\ S\ D^2$$

$$\text{For quadruple expansion engines } \frac{T\ max.}{T\ m} = 1.25$$

$$\text{and } T\ max. = 0.313\ p\ S\ D^2$$

The fibre stress for the crank shaft is taken at 6,000 pounds per square inch and for the line shaft 7,000 pounds. For the crank shafts of compound engines, for instance,

$0.196\ d^3 \times 6{,}000 = 0.363\ p\ S\ D^2$, and for the line shafts

$0.196\ d^3 \times 7{,}000 = 0.363\ p\ S\ D^2$

The mean referred pressure "p" is dependent on the ratio of expansions and the card or efficiency factor; it is the theoretical mean effective pressure multiplied by the card factor.

The theoretical mean effective pressure for any number of expansions may be taken from any engineering handbook.

$$\text{The ratio of expansions} = \frac{1}{\text{percent cut-off}} \times \text{ratio of}$$

cylinder volumes. Inasmuch as the stroke of all cylinders is the same, the ratio of cylinder volumes is the same as the ratio of their diameters squared.

It is more convenient to express "p" as a fraction of the absolute boiler pressure P (working pressure + 15 pounds). The process of obtaining the values of p for various cylinder ratios and engines is given in the following table taken from the *Bulletin of the American Bureau of Shipping*. The values of shaft diameters obtained from these factors represent closely the requirements of the American classification society.

Cyl. Ratio L^2/H^2	Ratio Expansion	Theoretical m. e. p.	p = m. r. p.
Compound engines. Cut-off .6, card factor .63.			
3	5.0	.522P	.328P
3½	5.83	.474P	.298P
4	6.67	.434P	.274P
4½	7.5	.402P	.253P
5	8.33	.374P	.235P
Triple expansion engines. Cut-off .7, card factor .58.			
5	7.15	.415P	.241P
5½	7.85	.390P	.226P
6	8.58	.367P	.213P
6½	9.29	.347P	.201P
7	10.0	.330P	.191P
7½	10.71	.315P	.183P
8	11.43	.301P	.174P
8½	12.14	.288P	.167P
9	12.86	.276P	.160P
9½	13.57	.266P	.154P
10	14.29	.256P	.148P
Quadruple expansion engines. Cut-off .7, card factor .55			
7	10.0	.330P	.181P
7½	10.7	.315P	.173P
8	11.43	.301P	.165P
8½	12.14	.288P	.158P
9	12.86	.276P	.152P
9½	13.57	.266P	.146P
10	14.29	.256P	.141P
10½	15	.247P	.136P
11	15.72	.239P	.131P
11½	16.43	.231P	.127P
12	17.15	.224P	.123P

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Steering Machinery—Merchant and Naval Types

Calculation of Forces Acting on Rudders—Power Required for Steering Engine—Description of Steam, Hydraulic and Electric Steering Gears

By George Murray

WHEN a ship is under way most of the forces acting on the rudder may be easily calculated, if we know the following particulars: Immersed area of rudder to waterline; speed of vessel; distance of center of gravity of rudder from centerline of rudderhead, usually termed center of pressure; angle the rudder makes with the centerline of ship.

Rudder Proportions

When not given by the shipbuilder the proportions of the rudder may be estimated.

$$\text{Area} = A = \frac{L \times D}{70}$$

A = immersed area of rudder in square feet.
L = Length on waterline between perpendiculars in feet.
D = draft in feet.

$$\text{Center of pressure} = L_1 = \frac{A}{D} \times C.$$

L_1 = center of pressure in feet.
A and D as for immersed area rudder.
C = a value based on the sine of rudder angle, with the following limits:

Angle 10 degrees = .248
20 degrees = .300
30 degrees = .347
35 degrees = .37
40 degrees = .391
45 degrees = .41

As the rudder stocks of vessels of ordinary proportions have their dimensions made to either the rules of a classification society in the merchant class or the accredited formula derived from experience in naval vessels the machinery operating these rudderstocks ought to conform to standard dimensions or capacities instead of the existing system, wherein the maker of this important marine auxiliary with the consent of the shipbuilder is free to install machinery with a very small margin of power over resistance. It will be noted from the July, 1920, issue of MARINE ENGINEERING *that Great Britain is about to set up in several districts panels with the idea of obtaining uniformity in deck fittings and auxiliaries including steering gear.*

If the rudder is rectangular and the angle the rudder makes with the centerline of the ship is 35 degrees, then the center of pressure is approximately three-eighths of its width. When the rudder is rounded the area may be obtained by Simpson's rule.

Balanced Rudders

When the rudder is balanced each part may be dealt with separately. Usually the forward part is smaller than the after part, therefore the resistance of the former would be deducted from the latter and the difference would give the actual resistance of the rudder to turning or the turning moment of the rudder.

Turning Moment

The resistance to turning or turning moment may be ascertained by substituting the proper values for the factors in the following rule:

If turning moment = M_t

Formula I. $$M_t = \frac{A \times V^2 \times L_1 \times C}{R} \times T = \text{foot pounds.}$$

A = immersed area of rudder in square feet.
V = speed of ship in knots.
L_1 = center of pressure in feet.
T = travel of chain in feet, i. e., proportion of circumference of quadrant embracing the angle "hard over" to "hard over."
R = radius in feet, center of rudder stock to center of chain on quadrant.
C = a number based on the rudder angle with values as follows:

H.O. to H.O. 70 degrees = 1.8
80 degrees = 2
84 degrees = 2.5
90 degrees = 3

Alternative Method

Formula II. $M_t = A \times \sin Q \times P_1 \times L_1$.

A = immersed area rudder in square feet.
Q = angle rudder makes with centerline of ship.
L_1 = center of pressure in feet.
P_1 = pressure on rudder in pounds per square foot, i. e., $1.12V_1^2$ (see Table I).
V_1 = speed of ship in feet per second plus 10 percent.

Alternative Method

To facilitate calculations by Formula II, Table I is useful.

It is not always possible to arrive at the turning moment by the formulæ above, owing to the information supplied by the shipbuilder consisting only of the diameter of the rudder stock and probably the length, draft and speed of vessel. The turning moment is then obtained from the strength of the rudder stock. It is the practice of many makers of steering machinery to allow a stress on the rudder stock well within the limits of ultimate breaking point as Table II shows.

Table I—Pressure in Pounds Per Square Foot

Knots	Pressure P_1 Lbs. per Sq. Ft.	Knots	Pressure P_1 Lbs. per Sq. Ft.
7	189.2	17	1,118
8	247.4	18	1,253
9	313	19	1,396
10	387.3	20	1,546
11	468.7	21	1,705
12	557.4	22	1,872
13	653	23	2,046
14	758	24	2,227
15	870	25	2,416
16	990		

For the purposes of this article it will suffice to assume there is no bending moment transmitted to the rudder stock by the quadrant, tiller or other attachment and that a simple turning effort is all that we allow for, using the strength of the rudder stock in accordance with the table for a given diameter of stock. If the turning moment is given, the diameter is found as follows.

We have the strength of stock from the following familiar formula:

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Table II—Torsional Strengths of Steel Rudder Stocks

Diameter, Inches.	Breaking Strength, Inch-Tons.	Elastic Limit, Inch-Tons.	Turning Moment Applied by Gear = ⅔ Elastic Limit, Inch-Tons.
5¼	846	348	232
5½	976	385	275
6	1,272	511	342
6½	1,618	575	383
6¾	1,812	644	429
7	2,020	718	479
7¼	2,245	798	532
7½	2,485	884	589
7¾	2,742	975	650
8	3,016	1,072	715
8¼	3,307	1,176	784
8½	3,617	1,286	857
8¾	3,946	1,403	935
9	4,294	1,527	1,018
9¼	4,662	1,658	1,105
9⅜	4,850	1,725	1,152
9½	5,051	1,796	1,197

$$\frac{f}{y} = \frac{M_t}{I}$$

where $y = \frac{D}{2}$; f = limiting stress; I = moment of inertia of section. Now $f = \frac{M_t \times D}{I \times 2} = \frac{M_t \times D}{\frac{\pi}{32} D^4 \times 2} = \frac{M_t \times 16}{\pi D^3}$

$$D^3 = \frac{M_t}{\frac{\pi}{16} f}.$$ D = diameter of stock.

For *f*, the usual stress allowed is 5 tons per square inch. From the foregoing, having arrived at the turning effort necessary to overcome the resistance offered by the pressure on the rudder with the ship under way, we may proceed to determine the power of the steering gear or engine.

Merchant Type Gears

In the merchant pattern of steering engine it is customary to base the engine power on the assumption that one of the cylinders in a two cylinder engine is required to overcome the friction of the gear and all the rudder connections. With a gear similar to Fig. 1 the power is obtained as follows:

Formula III. A x P x 2S x R = foot pounds (engine power) where

A = area of one cylinder in square inches.
P = working steam pressure in pounds per square inch.
S = stroke in feet.
R = revolutions of engine "hard over" to "hard over."

The revolutions of the engine $R = \frac{G \times H \times N}{M}$

where

G = circumference of quadrant at pitch line of chain.
H = fraction of circumference moved from H.O. to H.O.
N = number of teeth in worm wheel.
M = circumference of barrel at center of chain.

The diameter of the chain barrel should be at least 12 times the diameter of the chain.

There is no fixed ratio of engine power to turning moment but the best makers give:

$$\text{Ratio} = \frac{\text{Engine power}}{\text{Turning moment}} = 4.$$

Screw Gear

To fix the power ratio in this type of gear the following formula is the simplest:

Formula IV.

Turning moment, $M_t = \frac{A \times V^2 \times L_1 \times C_1}{L_2} \times T_2$ = foot pounds

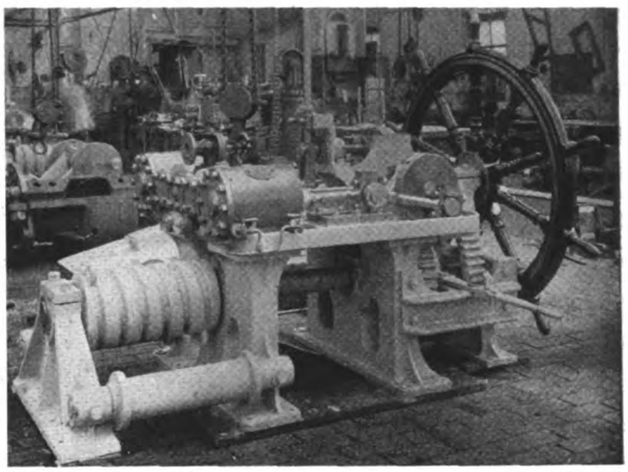

Fig. 1.—Horizontal Type of Steering Engine

where A, V, L_1 and C_1 have the values as in Formula I; T_2 is the travel in feet of the screw gear crosshead; L_2 is the shortest radius, i.e., distance from crosshead pin to center of ship when crosshead is hard over *and engine power* is obtained from Formula III.

taking $R = \frac{T_3 \times N}{p}$

where p = pitch of screw in inches or lead if multiple thread and T_3 = travel of crosshead pin in inches.

Having in a general manner described the methods used to fix the size of steering engines, several of the more important types of the merchant ship pattern will be briefly noted and illustrated.

Horizontal Engine with Chain Barrel

Of the many gears in use the premier position is held for small and medium sized vessels by this style of engine, no

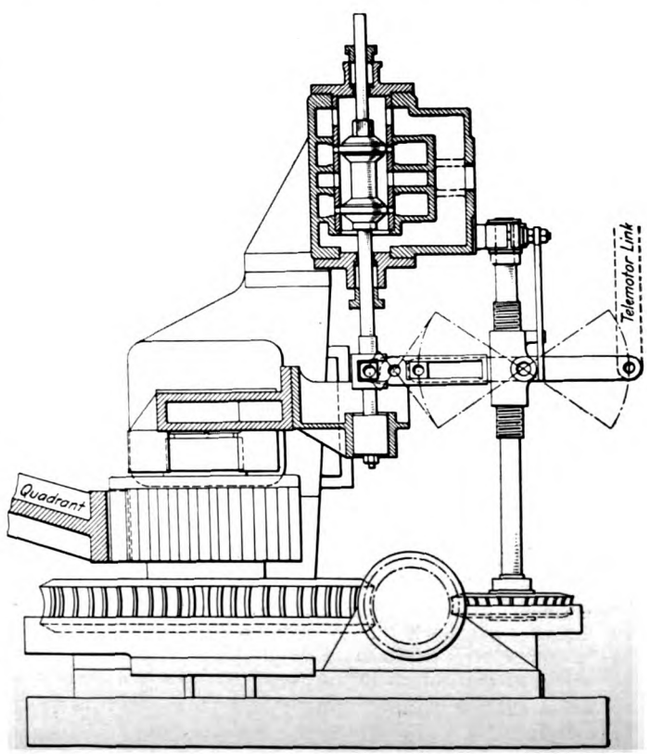

Fig. 2.—Section Through Vertical Quadrant Gear

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doubt on account of its simplicity, and the scope it affords for variety of design, combined with the almost unique record it holds for safety, and the ease with which it is manipulated.

Fig. 1 illustrates a steam and hand table or horizontal gear in which the barrel is extended, the shaft being carried by a separate bracket. Guide rollers are provided and the hand gear is supported on an independent bracket firmly secured to the main cheeks by brackets, one of which serves as the fulcrum for the hand lever operating the clutch suitably disposed between the steam and hand gear wheels. As a rule the control for this gear consists of steel shafting with miter wheels and suitable supports. The vertical shaft on the gear will be noted on the illustration.

Vertical Quadrant or "Wilson Pirrie" Gear

This gear has been in favor for many years. It is very rigid and being directly connected to the rudder stock the space occupied is small and there is the advantage that long chain leads are dispensed with. In recent years many improvements for centralizing the rudder and brake gear have been a feature.

Fig. 2 shows a section through this type of gear. On the rudderhead is keyed a toothed quadrant or in the "Wilson Pirrie" type a tiller is keyed to the rudder stock and the quadrant is connected to the tiller by strong eyebolts provided with cushioning springs. The quadrant teeth mesh with a quadrant pinion mounted on a pinion shaft and, in this example, integral with the worm wheel which is rotated by means of a worm cut on the crankshaft of the steering engine.

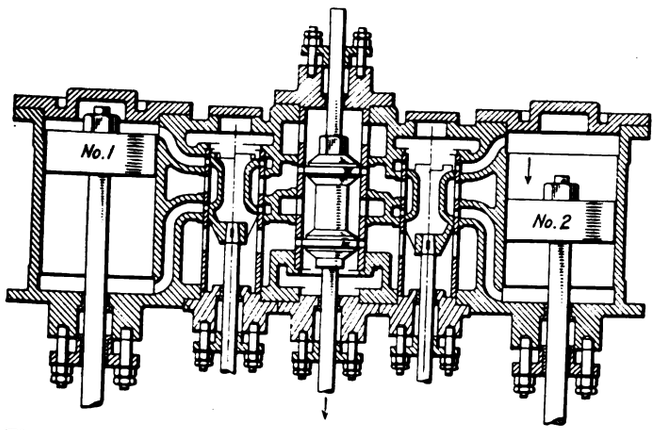

Fig. 3.—Section Through Cylinders of Vertical Steering Gear

It will be noted that telemotor gear control is fitted and a safety device known as the Stanhope lever is used to actuate the control piston, a circular guide taking any strain which might be induced by this lever arrangement. The means provided to return the control piston to its central position are clearly shown and, if taken in conjunction with the cylinder details, the action will be quite easily understood.

Control of the Gear

Fig. 3 is a longitudinal section through the cylinder of a vertical quadrant gear. The control piston is shown in mid position; No. 1 piston is at the top of stroke; No. 2 piston at mid stroke. The eccentrics are set in advance of the crank, therefore No. 1 valve is at mid stroke and No. 2 valve at the bottom of its stroke or travel. If the telemotor link is pushed down with the arrangement in Fig. 2 the control piston moves down causing piston No. 2 to move down, rotating the worm shaft and small worm wheel on the control shaft. This shaft has a screw on which a suitable thread is cut and carries the lever fulcrum nut by means of which the reversing or centralizing of the control piston is effected.

Hydraulic Steering Gear

As there was no reliable controlling mechanism till a few years ago this gear did not receive the attention it deserved, but with the advent of the motorship, owners and shipbuilders desiring to eliminate steam gears have adopted this type.

Fig. 4 shows a modern gear which is a combination, consisting of a constantly running electric motor, driving a variable speed and reversible pump, which delivers oil under pressure to either of two cylinders. These cylinders are fitted with rams having bearings for the journals of a steel crosshead, provided with an aperture to take the circular end of a forged steel tiller securely keyed to the rudder stock. The control for this gear is an adaptation of the telemotor, giving very sensitive governing and great latitude in maneuvering.

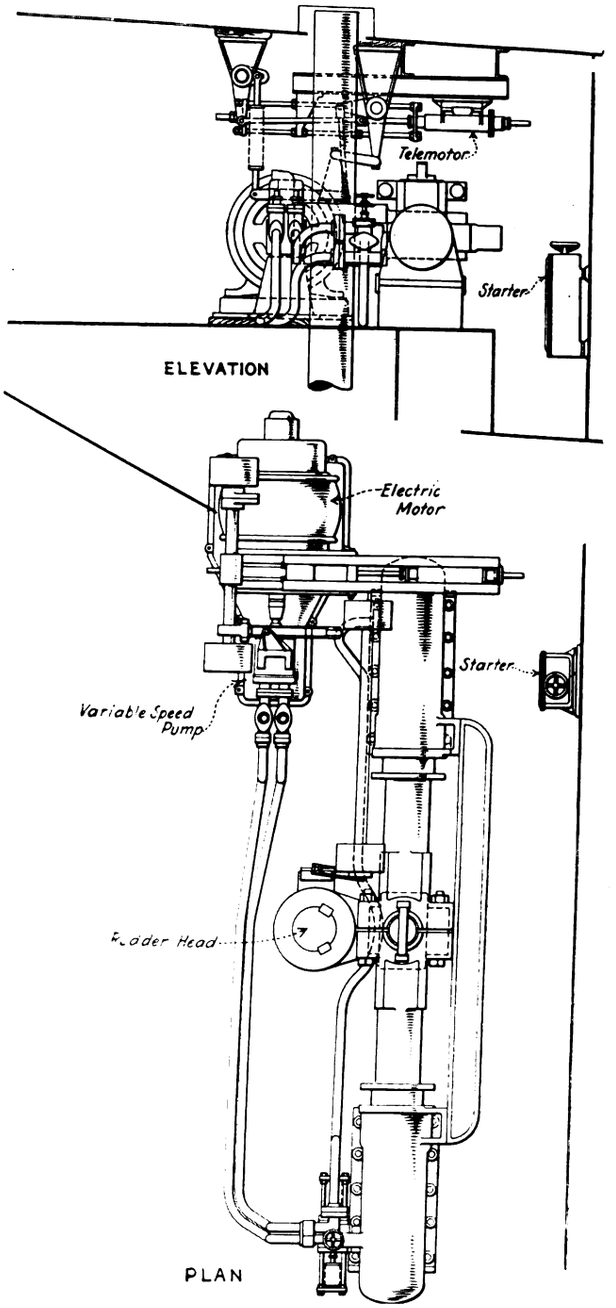

Fig. 4.—Hydraulic Steering Gear

If we suppose the levers in the relay system, which controls the variable speed pump, to be moved down on the left

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by the spring link, this sets the pump in motion and transmits oil under pressure to the cylinder and forces the ram to one side. In order to maintain the position assigned to the rudder by the steerer, what is known as a differential gear is fitted. This gear returns the eccentric of the pump to its neutral position, when no oil is transmitted, thus holding the rudder at the proper angle.

Steam Screw Gears

Screw gears operated by hand were among the first styles used. This gear has much to commend it. It is self-holding, is of simple construction, will work well after considerable wear and may be constructed to suit any size and type of vessel.

Fig. 5 shows a well known type of gear for use on a large liner. The screw is placed forward of the rudder stock, strong

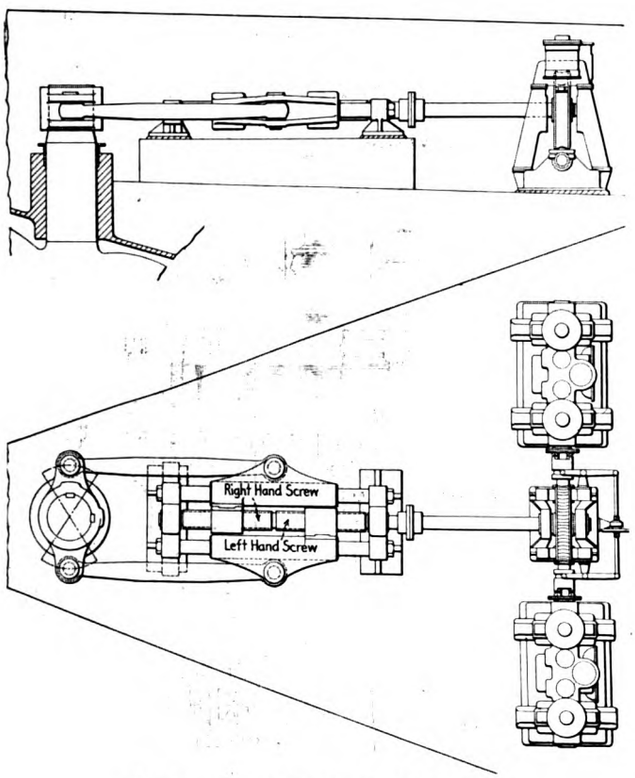

Fig. 5.—Steam Screw Steering Gear

steel connecting rods being attached to a forged steel crosshead keyed to the rudder stock. On an extension of the screw shaft is fitted a worm wheel which gears with a worm driven by the steering engines. The engines are of the marine pattern. One engine acts as a standby. A clutch gear is arranged so that as one engine is disengaged the other is coupled to the worm shaft.

Naval Gear

In British naval practice the most common style is the right and left hand screw gear placed in a compartment near the rudder, with a train of cast steel spur wheels as the reduction gear between the line shaft from the steering engine (which is usually placed in the engine room) and the screw shaft. Occasionally there are two screw shafts, side by side, one having a right and the other a left hand thread. The nut on either screw shaft is provided with an opening to take one end of the connecting rod, the other end of which fits a similar opening in the forged steel crosshead keyed on the rudder stock.

There is usually an auxiliary means of steering consisting

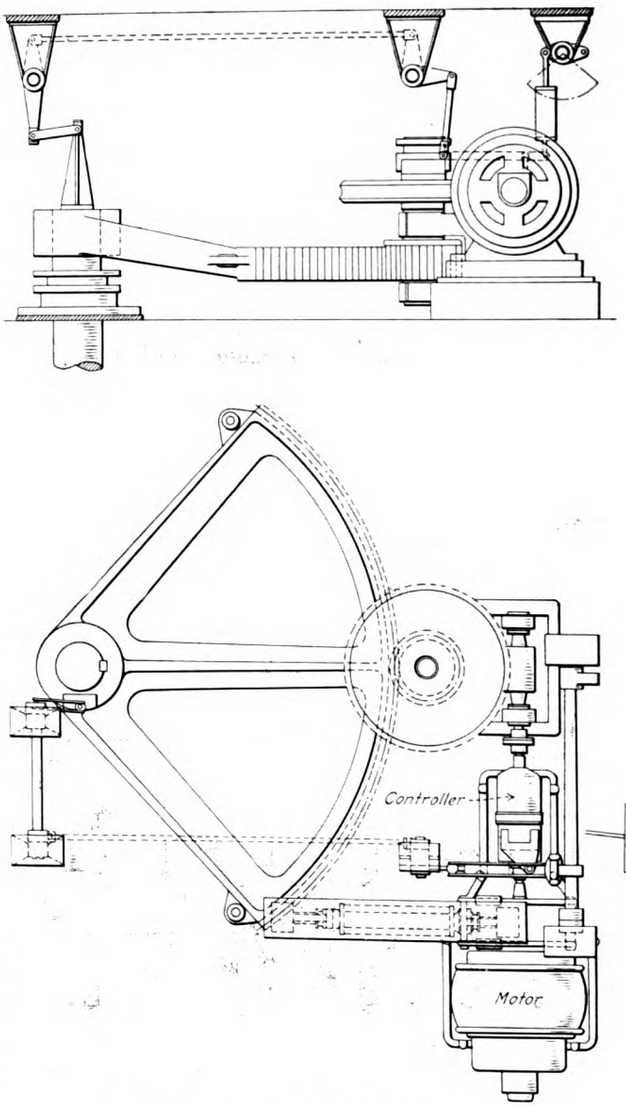

Fig. 6.—Electric Quadrant Steering Gear

of several large handwheels mounted on a shaft which is clutched to the screw gear simultaneously with the withdrawing of the engine clutch. An alternative gear consisting of a William Janney or Hele-Shaw variable speed hydraulic

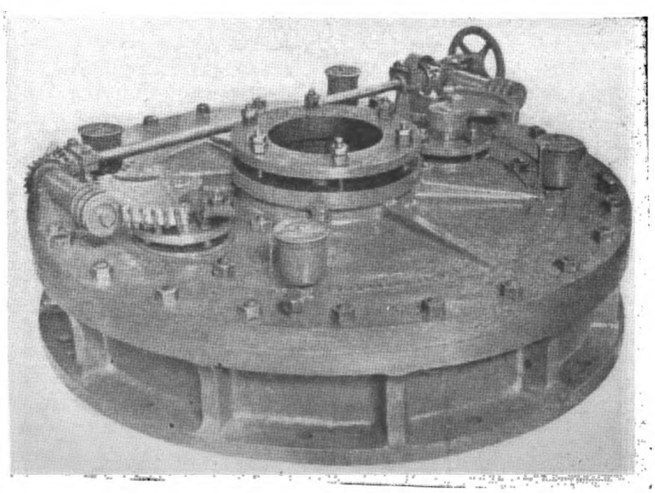

Fig. 7.—Outside View of Rudder Brake

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motor with an electric motor as its prime mover is a potent feature of the newest vessels.

TABLE III. PARTICULARS OF RECENT STEAM SCREW GEARS

Turning Moment, Foot-Tons	Rudder Stock Diameter, Inches	Diameter of Screw, Inches	Engine Dimensions, Inches	Weight of Engine, Pounds	Weight of Screw Gear, Pounds
20	7	4½	5–5 / 5	1,120	3,136
60	9	5½	7–7 / 6	2,016	3,584
100	11	6½	8–8 / 9	3,920	4,480
200	15½	7½	10–10 / 12	6,384	8,960
240	17	8½	11–11 / 12	6,720	12,320
375	20	10¾	13–13–13 / 13	16,800	22,400
500	26	2–10¾	14–14 / 14	16,240	23,520 (each)
600	28	13	17–17–17 / 14	22,400	40,320

Electric Quadrant Gear

In the American Navy a modern adaptation of the quadrant gear has come into favor, as illustrated by Fig. 6. It consists of a toothed quadrant forced on the rudder stock, the

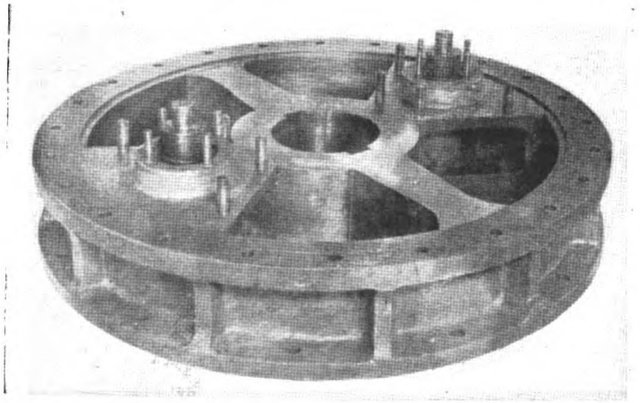

Fig. 8.—View of Rudder Brake With Cover Removed

quadrant meshing with a pinion attached to a pinion shaft. On the opposite end of this shaft a worm wheel is freely mounted but capable of becoming integral for rotating the shaft by a strong clutch. The worm wheel receives its motion by gearing with a worm operated by a variable speed motor or reversible electric motor, the starter for which is controlled by a relay system in much the same manner as the mechanism described in the paragraph dealing with "hydraulic gears."

Rudder Brakes

In self-holding steering gears such as screw gears, also in gears of the hydraulic ram type, it is not essential to introduce a brake but with other designs the importance of a good brake cannot be underestimated. A primitive form consists of a grooved metal segment attached to a tiller and a hard wood block which is forced against the segment by a long lever operated by a screw and nut.

There is also a form of brake similar to that used as buffers on the railway termini, having two hydraulic cylinders fitted with pistons, the outer ends of the piston rods being attached by pins to a crosshead on the rudder stock.

A very good example of the rotary pattern is shown in Figs. 7 and 8. The apparatus consists of a rotary piston keyed to the rudder stock and well fitted to a casing surrounding the stock, the casing having a strong flange bolted to the deck. There are four compartments filled with liquid. Ported segments with cocks and passages give access from one compartment to the other compartment situated on the same side of the rotary piston. In operation with the cocks open the rotary piston simply forces the liquid from one compartment into its neighbor, but when it is desired to cushion the rudder the cocks are partly or fully closed at will without interfering with any other part of the steering machinery.

The piston floats in oil which prevents excess of wear and the rudder and stock may be supported solely by the casing for hung rudders in ships having sterns of the cruiser type.

Portable Electric Rivet Heating Devices

ELECTRIC rivet heaters in general embody advantages of cleanliness, ready movement from place to place in the shop and rapidity of heating. The United States Electric Company, New London, Conn., appreciating the need for this equipment in boiler, railroad, and structural working shops has developed the rivet heating devices illustrated.

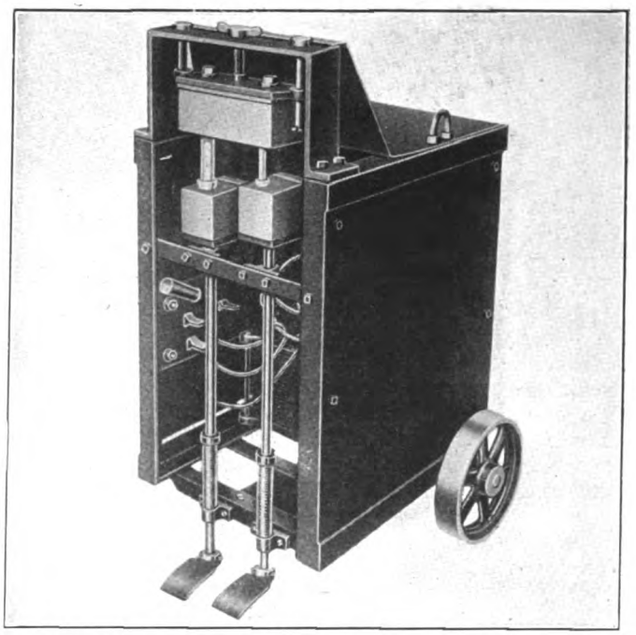

Fig. 1.—Rivet Heater, with Capacity for ¼-Inch to 1½-Inch Diameter Rivets

The heater shown in Fig. 1 has a capacity of rivets from ¼ inch to 1½ inches in diameter by 6 inches long. The time required for heating a rivet of the largest size is about 30 seconds.

The device is built in three types A, B and C with electrodes arranged to heat two, four or six rivets at one time. The large type C machine can heat twelve pin rivets per minute, which is as fast as they will ordinarily be required. Ten, 15 and 20 kilowatts, respectively, is the power consumption of the machines, depending upon the diameter of rivets to be heated.

A pan is supplied with the heater when it is desired to

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hold a quantity of rivets in front of the operator or heater, and the rivets are easily placed by hand in the electrodes and removed with the tongs when heated. The operation is simple. The control switch being set for the size of rivets to be heated, the operator presses down on the foot lever and places a rivet between the electrodes until the desired heat is obtained. By heating in series after the first two rivets are heated, there is always a hot rivet ready for the riveter, and the operator always can control the current by removing one rivet, eliminating the pulling of a switch. The switch will be supplied if specified so that it will not be necessary to remove the rivet. The machine operates on 60 cycles and 220, 440 or 550 volts, single phase.

The automatic rivet heater, illustrated in Fig. 2, is built to heat rivets when making long runs on one size of rivet, heating as high as 12¾-inch by 2½-inch rivets per minute. The machine is equipped with a control switch, the disks being arranged to hold any size rivet and accommodating 32 at one loading. The electrodes can be adjusted for any length of rivet up to five inches long and timed to give the desired heat in the rivet.

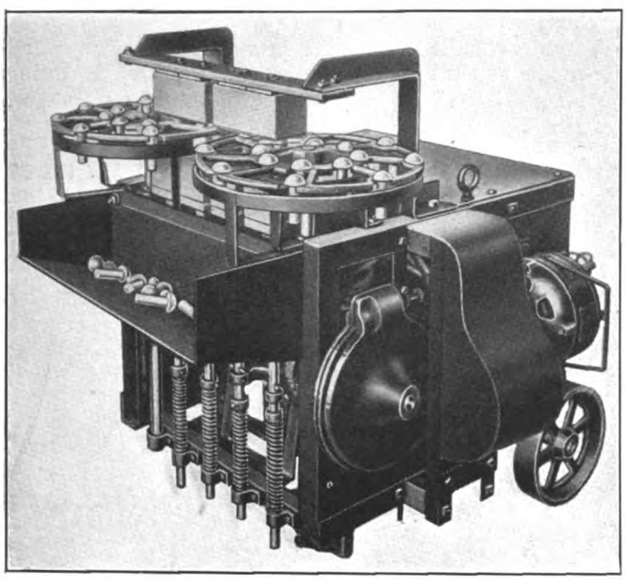
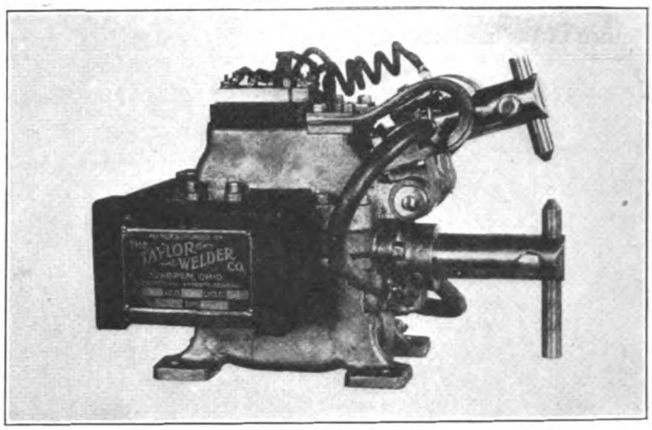


Fig. 2.—Automatic Electric Rivet Heater for Use When Making Long Runs on One Size of Rivet

Bench Type Spot Welder

A NEW spot welding machine of the bench type, having a capacity of two pieces of No. 30 to No. 16 gage sheet metal, has recently been put on the market by the Taylor Welder Company of Warren, Ohio. The machine has a cast copper frame which acts as a secondary and adds to its efficiency. Two horns of cold drawn copper 1¼ inch in diameter protrude from the machine, the upper horn being capable of movement through a distance of one inch. The lower horn is made adjustable by drilling three sets of holes in the base and setting the horn to suit the work, a long electrode being furnished to meet this condition.

With the lower horn in its highest position the distance between the two horns is three inches. This distance can be increased to five inches when the lower horn is in its lowest position. The transformer has a capacity of 3 kilowatts and a 4-step regulator is used for adjusting the current. Cooling is effected by the circulation of water through both the upper and lower horns. The floor space occupied by the machine is 10 inches by 17 inches and the extreme height from the bench is 12 inches. An automatic single pole switch closes the circuit and the upper horn and contact point is brought against the work by the operation of a foot pedal, not shown in the illustration. The approximate weight of the machine is 150 pounds.

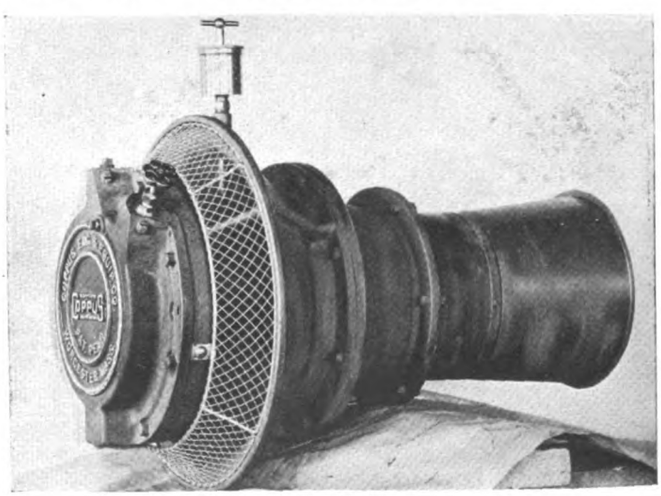


Bench Spot Welder with Water Cooled Welding Horns

Blower for Forced Draft or Ventilating Service

SCREW blade propeller blowers which deliver air in lines parallel to the axis of the machine have been added to the line of blowers manufactured by the Coppus Engineering and Equipment Company, Worcester, Mass. The Coppus "Vano" blower is designed in two types for turbine and electric drive.

The principal feature of this blower is a stationary guide vane of special design located beyond the propeller. The individual guide vane blades subdivide the air current leaving the propeller radially. These blades, which have a curvature increasing in the direction of rotation of the propeller, concentrate the air current and give it an added acceleration inside the stationary guide vane so that a considerable part of the air pressure is produced in the vane. Much of the end thrust is thus taken up by the stationary guide vane casing.



Turbine Drive Blower

Because of kinetic energy, the streams into which the flow of air has been divided by the guide vane blades rotate slightly and converge towards the axis as they leave the casing, so that the entire air flow is impelled beyond the guide vane.

The blowers are used for undergrate or forced draft service in hand fired boilers and also for ventilating purposes.

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Cost Accounting and Estimating*

By H. H. Schulze†

Cost accounting and estimating are so closely allied that it is not possible to treat of one without the other. In early days, cost accounting as applied to ship work did not receive careful thought or attention but was considered more in the nature of clerical work; during later years, and especially since the cost plus form of contract came into being, cost accounting has become better understood and is today considered among the most important departments of the shipbuilding business. Cost estimating occupied much the same position as cost accounting, and few shipyards reduced their cost estimating to a systematic basis. It is therefore the intention of this paper to treat mainly of the second portion of the title and to describe the methods adopted in the effort to obtain uniform results.

THERE are really three main functions of cost accounting: First, for determining the profit; second, for submitting statements during construction to the operating manager, so that he can anticipate or investigate the overrunning of estimated costs; third, for estimating—that is, to determine the basis upon which to submit bids for similar work. The financial statements required for each of the above purposes are entirely unlike.

For determining profit but one figure is required, namely, the completed cost; for use of the operating manager the statement should be divided into groups corresponding with the division of his operating departments; for determining the cost for future work the statements should be divided by groups represented by physical quantities so that unit rates can be determined, to be applied to similar physical quantities calculated for the proposed work. A good accounting system should provide means to indicate all the above.

The number of groups in the accounting system depends largely upon the variety of work constructed. It is understood that, should but one type of commodity be constructed in which the relation of each operation to the other is always constant, but one factor would be necessary to determine the rates for similar commodities. In ship work, however, because of the varying relations of the many items and trades entering into the numerous types of vessels, it becomes necessary to subdivide the return cost into the correspondingly numerous items, which broadly may be classified in groups of hull and machinery.

The hull is usually divided into general items such as bonds, insurance, watching, temporary electric service, plans, trials and delivery; steel hull, including loft work, staging, launching, hull castings and forgings, and structural hull; woodwork, including joiner and carpenter work; also painting, hull piping, ventilation, electric work, steering gear, warping gear, boat gear, doors and hatches, airports, inside and outside fittings, handrails, deck covering, masts and rigging, and outfit. In naval work there must be such additional items as ammunition handling, turrets, installation of ordnance and armor.

The machinery is generally divided into main engine, condenser, pumps, boilers, stacks and uptakes, forced draft system, fuel oil system, piping, lagging, shafting, bearings, propellers, floors and gratings, tanks, and auxiliaries, including feed heaters, evaporators, distillers, oil coolers, auxiliary condensers, refrigerating, heating, fire extinguishing and disinfecting plants, together with tools and spares.

The above groups are more or less subdivided, according to the nature of the work constructed at the particular plant.

The return cost for each of the above items should be given in the three divisions: material, labor, operating expense, termed overhead.

Material is comprised of purchased material, *i. e.,* items requisitioned and purchased directly for a particular ship; and storehouse material, *i. e.,* material drawn from the general storehouse and applied directly to the vessel. The latter consists of such items as standard pipe, fittings, bolts, nuts, etc.

Labor, sometimes termed direct labor, is that portion of the labor which is charged directly to the vessel.

Operating expense, or overhead, consists of both material and labor and constitutes just as much a part of the cost as either the direct labor or material. It consists of material and labor which is more accurately distributed by prorating than by the direct charge.

The division between direct labor and indirect labor is by no means uniform at all plants. The general principle which determines the division is that direct labor should include all labor where little or no judgment is necessary by the operator in the division of his time. Where it becomes necessary for the foreman or quarterman to estimate the division of his time between the several vessels or jobs, such labor should be classified as indirect labor. An ideal system would be one where all the labor could be accurately distributed directly to its appropriate job. Unfortunately, much of the labor entering into ship construction cannot be charged direct without the arbitrary distribution by the employee, and it must therefore be included in the operating expense.

The material charges in the operating expense embrace such items as light, heat, coal, water, etc., and the labor includes the compensation of foremen, leading men, inspectors, clerks, messengers, cleaners, timetakers, etc. In addition to the above there is included, as administration, selling and general expense, a proportionate part of the cost of the office of the manager, sales department, treasurer, accounting department, purchasing department, plant engineers, service department, etc.

The distribution of the overhead in some businesses can be apportioned according to the units manufactured, where such units are all the same character, but in shipbuilding it has generally been customary to apportion the indirect expense as a percentage of the direct labor. Each department in the shipyard should have an account to which the expense of the department is charged, so that it may be possible each month to prorate the expense of that department among all of the direct labor which it performed for that period.

Since the distribution between the direct and indirect labor is not uniform at various shipyards, it can be seen that direct costs of one yard are not comparable with another yard. To make a proper comparison, it would be necessary to adopt not only a uniform cost system, but a uniform force report so that the distribution between the direct and indirect labor would be the same at all shipyards.

Cost estimates are prepared primarily to form the basis

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 18, 1921.

†Bethlehem Shipbuilding Corporation, Ltd.

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of a bid or a selling price, and secondarily for the information of the general manager so that he may be advised what allowance has been made to each department so as to assist in the reduction of operating costs. The importance of the latter function is being recognized more and more, and an excellent paper on this subject, entitled, "How the Cost System Assists the Management in the Reduction of Operating Costs," was presented by Mr. William B. Ferguson, assistant to the president, Hog Island, before the Society of Industrial Engineers, on March 26, 1920.

Estimating

While the selling price is determined by the amount the consumer is willing to pay and the manufacturer willing to accept, few lump-sum contracts are taken without some form of estimate. The acceptance of a contract on a competitor's bid involves the dangerous assumption that the competitor has not made an error and that the purchasing power and manufacturing efficiency of both plants are equal.

The builder usually prepares his estimates on the same basis and, after submitting several bids, soon ascertains what allowance must be made over the estimates prepared by him to compete with other bidders. Thus, if he is consistently high, with a constant percentage as margin, he knows that, if he desires to obtain the contract, it is necessary to correspondingly reduce the amount of margin.

All estimating—in fact, the solution of all engineering problems—is performed by comparison. A formula is merely an expression endeavoring to reconcile by functions all the various conditions entering into the problem, and the closer the functions and formula represent the condition the more uniform will be the coefficients in the formula. The personal element in the selection of factors to represent the proposed condition is one of the reasons for erratic results in estimating.

Designing and estimating would be reduced to a more scientific basis if, under the given engineering condition, the same dimensions would be obtained at all times, irrespective of the person who is solving the problem. Again, after the size has been determined, if the same weight and cost would be obtained, then estimating would be reduced to somewhat of an exact science. The solution of this problem has been attempted by the method described herein, and, as far as it has been applied, has been found to be very successful.

There is usually a time limit to every estimate, and the problem is to make the best use of this time. One essential is to proportion the time according to the money value of the item, and another is to avoid repeat operations in every succeeding estimate. For example, it is unwise to devote a large amount of time to the calculation of structural foundations and then hurriedly figure the shell plating, merely because this portion is easy to calculate. Again, it is not desirable to devote a large amount of time to an intricate iron casting and to approximate the weight of a composition casting costing several times as much. Repeat operations are avoided by the standardization of particular items, as will be described below.

A good estimating system should be flexible enough to make the best use of all the particulars specified by the purchaser, and where these particulars are not specified it should provide means for determining the sizes according to the best standard practice.

Since estimating consists largely of a comparison with past practice, it is of importance that items to be compared should be on exactly the same basis; otherwise the estimator must make the proper adjustment in his mind before applying the new rates. In former years, when there was no great fluctuation in the material and labor market, it was sufficient to use the price-per-pound method for both material and labor, making slight modification as found necessary. When large fluctuation in material cost and labor rates occur, the mind cannot readily compensate for the varying rates, and comparisons with previous returned cost and with previous estimated costs become of no practical use; therefore a method should be adopted of placing all estimates on the same basis, viz., uniform base for material and labor rates.

Uniform Base for Material and Labor Rates

By an adoption of a standard schedule of material unit rates for the various commodities, and by reducing labor to hours, estimates can be placed on a uniform basis and would not only be comparable one with the other, but would also be available for use at any period by applying current rates to the quantities and to the labor hours which, combined with the current expense rate, produces an estimate on current rates. The relation of the current estimates to the standard estimate should be very nearly constant for the same period.

It is not alone sufficient that details be calculated accurately, but every estimate should be subjected to a check method to determine whether the total represents a reasonable figure. To accomplish this, resort is made to check summary cards, which indicate the quantities and costs combined in large groups, together with appropriate weight factors, and unit rates of material and labor.

The character of the estimate depends largely upon the character of the inquiry. Frequently inquiries do not give any particulars, and sometimes not even the general dimensions. This probably means that the prospective purchaser is merely feeling the market, and in such cases approximate estimates are prepared in condensed groups, using as a basis the check cards of the nearest similar vessels. In the hands of an expert with good judgment, such check-card estimates will give results which compare quite favorably with the detailed estimates.

While space will not permit describing in detail the method of determining the dimensions of vessels and their horsepowers to fulfil required conditions, it might be briefly stated that recourse is made to design cards bearing lineal ratios, displacement and weight co-efficients, also to the freeboard tables and to model experiments conducted by Admiral Taylor and Constructor McEntee. The freeboard tables have been reduced to curve form, making the determination of depth for any draft, length and extent of erections a very simple operation. By reducing the model results of Taylor's Standard Series to a mechanical operation and plotting curves of the relative performance of known models, the horsepower can be quickly determined, and with a reasonable degree of certainty.

In cases where only the general particulars are given, an estimate is prepared by the condensed groups without going into great details, except for the larger groups, such as structural steel hull.

When complete plans and specifications are submitted, or when it is probable that the prospective purchaser seriously contemplates construction, estimates are prepared in full detail. One of the first steps in preparing such detail estimates is the determination of the sizes of auxiliaries purchased from subcontractors and the submitting of the necessary inquiries. The subcontractor, before he will quote, will require complete information regarding the auxiliary, which necessitates not only the engineering knowledge for determining but also knowledge as to how this material is furnished by the subcontractor. In most cases the time required to prepare the estimate is governed by the time necessary to receive prices from outside contractors. This is particularly true when the auxiliaries are not of their standard manufacture.

Having briefly described the general principles and the several kinds of estimates, a description of the procedure in preparing a detail estimate will now be given.

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PREPARATION OF DETAIL ESTIMATE

In a large company the work of estimating is divided among men who become specialists in their particular line. For instance, it is very desirable to have the quantities for woodwork, both carpenter and joiner, calculated by someone who has had practical experience in this character of work; piping should be determined by an expert piping man. The material is generally calculated in the same units as it is purchased—that is, steel by the pound, lumber by the board foot, floor covering by the square foot, etc.

The costs of construction bonds and insurance depend upon the time of construction and the amount of the contract and are estimated on this basis. The cost of the trial trip and delivery depends upon the horsepower, duration of the trial, size of the vessel and the point of delivery, and where this amounts to a considerable item a detail estimate is prepared, taking into account the consumption of fuel, lubricating oil, stores, number of crew, commissary, transportation charges, compass adjustment, docking, towboat charges, etc. In cases where it does not involve a considerable item the cost is merely based upon similar vessels.

The cost of plans is based upon the number of hours required in the drafting rooms, and it has been found that the best criterion for determining these hours is the total hours of direct labor for constructing the hull and machinery separately. Staging and launching depend upon the size of the vessel and the duration of the construction period, and, based upon these factors and the return cost of similar work, proper allowance is made for these items.

The weight of structural castings and forgings is calculated after the sizes have been determined from the registration rules. Practically all vessels are classified in one of the society rules, such as the American Bureau of Shipping, Lloyds, or Bureau Veritas, and if not classified, the scantling and sizes are usually obtained from the above rules.

HULL

The structural hull is by far the largest item of cost and weight in the vessel, and it is therefore essential that the quantities be determined with the greatest accuracy possible. Coefficient methods have at times been adopted, but the use of such methods is dangerous, particularly in the hands of the inexperienced or when a complete knowledge of their derivation is lacking. Usually the approximate lines are sketched, from which curves of shell expansion, floor areas, areas of bulkheads, decks, and the length of frames and reverse frames are obtained. From the above information and the scantlings obtained from the classification rules, quantities are calculated in detail. The grouping is always done in the same manner so that comparisons can readily be made. This is very essential and applies to other jobs as well.

The steel hull is calculated in three groups, each divided into regular classified subgroups. The first group consists of the continuous running members below the topmost structural deck, namely, transverse framing, longitudinal framing, keel plates, shell plating, inner bottom plating and decks. The second group consists of the other members below the structural decks and includes bilge keel, engine, boiler, and miscellaneous foundations, transverse and longitudinal bulkheads, chain lockers, shaft alleys and miscellaneous trunks and ducts. The third group consists of all the erections above the continuous deck, including structural work for the poop, bridge and forecastle, bulwarks, casings, etc.

The steel has been classified in the above logical groups in order that the result can be checked by coefficients obtained from similar work. The quantities are net weight, calculated in pounds, and are classified as to plates, angles, channels, bulb angles, half rounds, tees, etc. The net quantities are transferred to the cost sheets and due allowance made for wastage, to obtain the gross quantity or amount to be purchased. To these gross quantities current unit rates are applied, obtaining thereby the estimated purchase price of this material.

The labor on steel, as in all the other jobs, is estimated in hours, being based upon the returned hours on similar work; to these hours are applied the current averaged hourly earnings of the particular plant, giving the labor in money value.

Joiner work is calculated in board feet and necessitates a knowledge of the kind of materials and dimensions ordinarily used for carlins, studs, sills, plates, internal and external sheathing, straight and diagonal bulkheads and for the various items of furniture. Hardware, fastenings, glass, etc., are listed and priced, unless the time is insufficient, when they are taken by comparison with other work. As with steel, the quantities of lumber are transferred to the cost sheet, due allowance made for wastage, current unit rates of lumber are applied, giving the estimated cost of this material. The labor in hours is estimated, based upon the corresponding prices per board foot obtained in similar work.

Carpenter work is calculated in the same manner as joiner work, but, in addition to the number of board feet, lineal feet are calculated, since the labor is best applied on the basis of the lineal feet as laid by the carpenters.

The amount of paint is calculated in pounds, based upon the extent of the surface covered, treating separately the underwater body, the ordinary steel work, the joiner work and the varnishing and decorating. While cement amounts to a considerable item in the displacement, it does not involve much cost, and this is usually approximated, taking into consideration the size of the vessel.

The hull piping, including cargo oil mains, fire main, drainage and plumbing, is calculated in detail from a single line sketch plan made to suit the special requirements. The number and weight of flanges, fittings and valves are listed and the pipe is calculated in pounds, separate quotations being received for the plumbing fixtures themselves.

A similar procedure is followed in ventilation where this is an elaborate system; otherwise, the ordinary engine fireroom and hold ventilators are obtained by applying quantities derived from similar work. The costs of doors, hatches, airports, hand rails and deck coverings are obtained by counting, or calculating the number and size from the plans, and applying to the quantities, so obtained, prices and weights derived from similar work. After applying to such systems as steering gear, warping gear, anchor gear, boat gear, etc., the prices of auxiliaries received from the subcontractors, the remaining items are estimated by comparison with similar work. Masts, spars and rigging are calculated in detail—that is, the number of pounds of structural steel, the number, diameter and length of booms, the lineal feet of wire rope, the pounds of running rigging and the number and size of various blocks required.

The galley and deck outfit in some cases is very elaborate, and complete schedules are often forwarded to subcontractors for silverware, glassware, linen, bedding, etc., and these prices are applied.

MACHINERY

The machinery quantities are figured in detail and in the same units as the material is purchased. Within the time limit it is of course impossible to calculate the weights of each casting, such as cylinders, columns, bedplates, condenser heads, etc.; and in some shipyards the weights of such items are derived from an empirical formula, applying coefficients from the nearest similar work. For those shipyards which have a sufficient staff to enable weights and quantities to be classified and standardized, excellent results are obtained

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with a minimum amount of time. Curves are developed for the various types of cylinders giving the weights for any diameter and stroke, one series for high pressure cylinders with piston valves; another series for intermediate pressure cylinders with one piston valve, with two piston valves, and with slide valves; and a similar series for low pressure cylinders with various types of valves. Similar curves are developed for all parts of the main engine, including bedplates, bearings, columns, guides, all items of the reciprocating group, the valve gear, etc., so that it is possible without detailed calculations to obtain the weights which meet the required engineering conditions. This same procedure can be adopted for all portions of the machinery estimates, including condensers, boilers, stacks and uptakes, shafting, bearings, etc.

One of the largest and the most difficult items in steam engineering is the steam engineering piping. The best procedure for calculating steam piping is to make a quick layout of the machinery with a single line sketch plan of the various piping systems, including main and auxiliary steam, main and auxiliary exhaust, suction and discharge piping, and to calculate from this layout all the valves, flanges, pipe and fittings in the same manner as for hull piping. Where the time limit will not permit of such detailed layout, piping is estimated in separate groups, as described above, by comparison with the nearest similar job; but here again great care must be exercised, since the several owners' requirements vary to such extent. One company might require copper pipe and composition valves for the system, whereas ordinary good practice would consist of wrought-iron pipe with cast-iron valves; and realizing that the former would cost several times as much as the latter it will be at once seen that the greatest care must be exercised in making assumptions in this group. The deck steam pipes, smothering pipes and heater coils for oil steamers sometimes consist of very large quantities, and, being comparatively simple, they are calculated separately.

Auxiliaries

The specifications cannot specify all sizes, dimensions and character of material, and therefore the estimator must have a complete knowledge of the character of the material and the size required for any portion of the machinery; for instance, in piping, it will be necessary for the estimator to know what connections are made to the various pumps, their size and character of piping. If the sizes of the condenser, air pump, and circulating pump are not specified, it will be necessary for him to know the best practice to determine these sizes. In reciprocating pumps he is required to know not only the size of the pumps, but whether they would be composition end, composition fitted, or with cast-iron cylinders—whether or not soft packing or metallic packing is required. The same detailed knowledge is required for determining all sizes and dimensions where not definitely specified. Having determined the net quantities, they are transferred to the cost sheet; due allowance for wastage, current unit rates are applied, obtaining the estimated cost of the material.

The labor, as with the hull, is estimated in hours, and in most of the groups is based upon the weight, though in some cases better results are obtained by applying unit rates, following the method of manufacture. Thus it has been found that in a condenser it is better to base the hours upon the number of tubes.

A summary of the hull and machinery is prepared from these detailed figures, and on this sheet is applied the current rate of expense. This is not constant for hull and machinery nor even for the separate jobs, since the expense rate of the various departments differ greatly, as described above.

The sum, then, of the material, labor and expense for the hull and machinery gives the estimated cost of the vessel. Throughout the process of estimating, check methods are continually applied, so that there is little possibility of a large error appearing in the process.

Standardization

To avoid repeat operations and to obtain uniform results, the various groups should be standardized. The general method of standardizing a group is, first, to ascertain the theoretical calculation by which sizes are determined; second, tabulate from practice the various sizes; third, apply the theoretical calculations and from practice obtain the coefficient so that the result may coincide with those usually adopted; fourth, calculate and tabulate results throughout the entire range of requirements. A few examples are as follows:

The size of the circulating pump depends upon the amount of steam to be condensed, the temperature of the sea water, the vacuum, and the percentage of the rated capacity of the pump in actual service. After having determined the amount of steam used by the various types of engines, the amount of water required by the theoretical calculation is determined and this amount compared with the rated capacity of the pump indicating that, in normal running condition, the pump is working at a certain percentage of its rated capacity. Tabular statements are then prepared for several temperatures of sea water and for predetermined water rates and vacuums for the several types of engines. Without calculation it is then possible to ascertain from this tabulation the normal size of a circulating pump for compound, triple, quadruple, turbine or electric drive, for several temperatures of sea water, the instructions giving the temperature to be used for the various routes.

The same method applies equally well to the hull jobs. In anchor gear, for instance, the size of the hawse pipe must be sufficient to prevent the chain shackles from fouling under all conditions. From practice, the clearance over the diagonal length of the chain shackle is plotted, to which is added the diagonal length of the shackle for determining the diameter of the hawse pipe. The length of the hawse pipe must be sufficient to permit of the proper housing of the stockless anchor. The top and bottom thicknesses and the dimensions of the lips are plotted from practice. With the standardized dimensions, hawse pipes are determined for all sizes of chains and the weights calculated. The dimensions of chain pipes, devil claws, cable clenches, hawse pipe covers and anchor davits are similarly determined and placed in tabular form. The weights and costs throughout the entire range are carefully calculated and tabulated, so that for any size vessel or any size chain the weights and standard costs of not only the above fittings but the windlasses, anchors and chains themselves can be immediately obtained either in detail or in total.

Application of Standardized Information

A brief description of the method of applying the standardized information is given by an example for determining the size of the main engine when not specified. A tabular statement is prepared, giving the minimum, normal and maximum horsepower; the size of the engine; the minimum, normal and maximum revolutions; together with reference plans, hull numbers, and condition of patterns for the various engines constructed, with intermediate sizes where the sizes constructed are not sufficient to cover the entire range of horsepowers. Based on propeller performance, a tabular statement is prepared, giving the normal revolutions for varying speeds and drafts. Following the direction of the typewritten instructions, it is merely necessary to ascertain from the latter table the normal revolutions for any given draft and speed, and from the tabular state-

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ment of engines pick out the proper size. Reference is then made to a weight and cost folder for this particular size of engine, from which can be obtained at once the total net weight, the total gross weight, the standard cost of material and hours of labor. Current cost is obtained from the above by factors.

Similarly, the proper size of the condenser may be determined, and reference is made to the weight and cost folder which contains a list of condensers advanced by intervals of 100 square feet. This is accomplished by increasing or decreasing the length of the condensers actually constructed. The weights and costs are carefully calculated from bills of material, actual casting weights being used for gross weights and scale or calculated weights for net weights.

The principal weight factors for propellers are the diameter of the tail shaft, diameter of propeller, and area of developed surface. In determining the developed surface, the indicated thrust-per-square-inch method was adopted, using the information as published by Admiral Dyson, together with the actual practice used on merchant ships.

Similar methods can be applied to nearly all other jobs, such as forced draft systems, boilers, stacks, uptakes, lagging, shafting, auxiliary condensers, feed water heaters, refrigerating plants, and even tools, instruments and spares.

While the machinery jobs lend themselves better to standardization, similar methods may be applied to the hull jobs, and a few of these will be described.

The determination of the weight of the structural hull resolves itself into two operations: First, the determination of surfaces and lengths according to the dimensions and model; second, the determination of unit weights for those surfaces and lengths. The surfaces and lineal dimensions can be determined directly from a series of standardized lines somewhat similar to those described in the very instructive paper by Mr. A. J. C. Robertson, appearing in Transactions of 1920. These standardized lines were developed by making use of the experiments of Naval Constructor McEntee appearing in the Transactions for the year 1919, and also from the various other model experiments. Investigations were also made regarding wetted surface formulæ in order that the wetted surface for any particular model could be quickly and accurately determined. Taylor's formula was adopted as being the simplest formula, the accuracy being dependent only upon the accuracy of the coefficient. A series of curves of coefficients has been developed so that for any length, for any breadth, for any draft, and for any block coefficient, the surface coefficient could be obtained within the desired degree of accuracy.

The results of the standardization of lines have been incorporated in a folder with typewritten instructions so that a complete set of lines can be at once drawn up for any condition without fairing, or that a particular cross section can be obtained without the use of a set of lines; also, that the areas of any particular cross section to any height and the girths of any cross section to any height can be obtained without the necessity of drawing lines or that the entire surface can be obtained by a simple calculation.

The unit weights are established by the classification society under which the vessel is constructed, and tables of coefficients have been established for laps, rivets, etc.

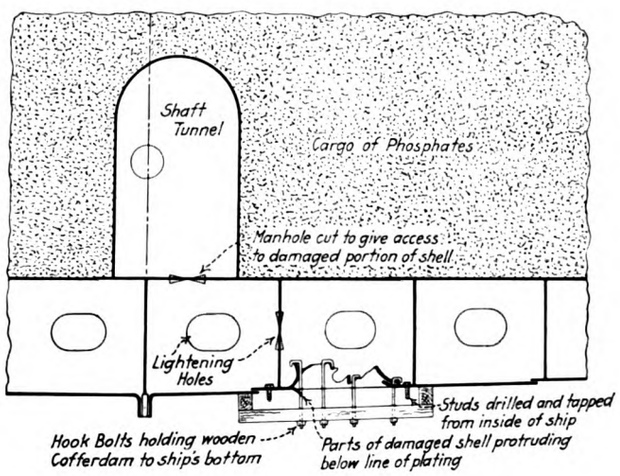
In joiner work standard drawings are made for the various items of portable furniture, such as berths, lockers, transoms, etc., and the number of board feet of lumber of various kinds, together with the amount of hardware for each of these items have been tabulated. The various kinds of bulkheads and joiner decks have been standardized for dimensions and the quantities reduced to lineal or square foot basis. The quantities for complete pilot houses and rooms for the various officers have been tabulated, so that it is unnecessary to make these detailed calculations for each estimate.

The work of standardization is performed during the intervals between estimates, and, when once started, the time saved on jobs already standardized can be utilized for further standardization. It is believed that the time-saving element and the uniformity and accuracy of results well warrant the labor expended; certainly, after the standardization is complete, the time required to prepare an accurate estimate is very much reduced.

A Difficult Submerged Repair Job Accomplished

By A. C. Waters*

THE Japanese steamer *Tamon Maru VIII,* which recently bunkered at Newcastle, Australia, had the misfortune when about to leave port to rip a hole in the bottom of her after ballast tank on a submerged anchor. The *Tamon Maru VIII* is a vessel of 2,977 gross tons, 327 feet long, 41 feet beam and 26 feet depth, and at the time


Shaft Tunnel
Cargo of Phosphates
Manhole cut to give access to damaged portion of shell
Lightening Holes
Studs drilled and tapped from inside of ship
Hook Bolts holding wooden Cofferdam to ship's bottom
Parts of damaged shell protruding below line of plating

Sketch Showing Extent of Damage to Bottom of S. S. Tamon Maru VIII

was carrying a full cargo of phosphates. The extreme dimensions of the hole were approximately 4 feet 6 inches square.

There is no dry dock at Newcastle, and, even if there had been, it would probably have been necessary to unload at least a portion of the cargo, which would have been ex-

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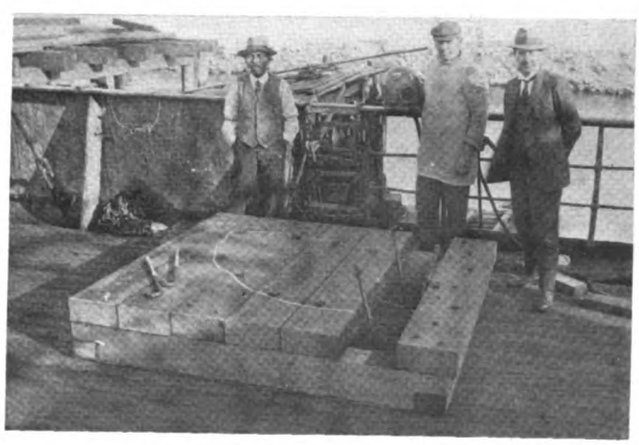

View of Cofferdam on Deck

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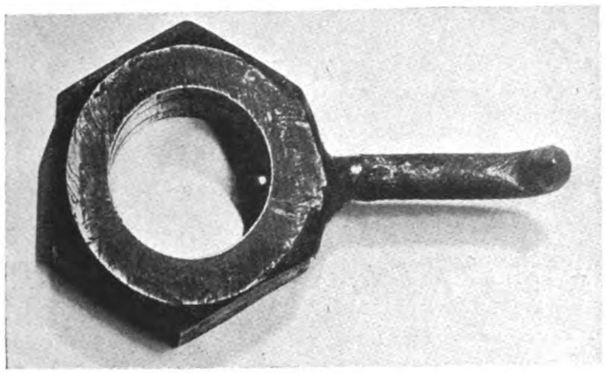
pensive quite apart from the fact that available wharfage space would have been difficult to find.

It was therefore decided to make the repairs while the vessel lay alongside the dolphin, and the Government Dockyard at Newcastle was invited to undertake the job. The work was started September 23 and the vessel was able to

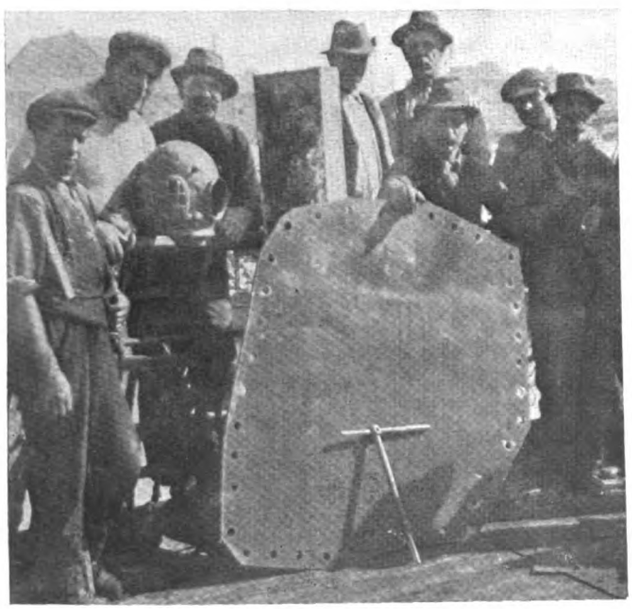


Clearance Nut for Locating Position of Stud Holes

leave port October 1, carrying Lloyd's certificate permitting her to travel to any part of the world.

The work was accomplished as follows:

A large heavy cofferdam, about 6 feet square, was first secured by hook bolts to the damaged portion of the shell by the diver. The after ballast tank was then pumped out, after which a temporary manhole was cut through the tank top in the tunnel, as the regular manhole entrance in the hold was covered with tons of cargo. The work of taking away the damaged portion of the plate, and tapping and fitting of ⅞-inch studs was all done inside the ballast tank



View of Patch Used to Repair Bottom

and within the boundary of this cofferdam; a risky performance, but the good job made by the diver allowed only a little water to enter the tank.

When all these studs were in place and the patch was taken account of from the inside, the manhole cover was secured in position and the diver sent down to demolish the cofferdam. A template prepared in accordance with the information taken from the inside of the vessel was then sent down with the diver. The holes in the template were large enough to easily fit over the ends of the studs. A clearance nut, as shown in Fig. 3, was given the diver and, by describing circles with this nut about the ends of the studs, the exact position of the center of each hole was obtained for punching the plate. This system of obtaining the exact position of each hole worked out so well that, although the plate was punched with proper sized holes and first shipped over the two long pilot studs, it went over the remainder of the studs at first trial, and was screwed up by the diver in very short time, the diver taking all he could on the bolts as the outside pressure increased during the pumping out of the tank. The nuts were further secured by upsetting the ends of the studs.

When the tank was pumped out, examination from the inside showed that the patch was absolutely dry, not even showing signs of a weep. The extreme dimensions of the patch were about 4 feet 6 inches by 4 feet, and it was secured to the shell of the vessel by ⅞-inch studs about 4 inches apart. The patch was ½-inch thick, and after inspection was covered by about 4 inches of cement, which thickness existed elsewhere in the tanks.

It might be added that the remaining portion of the damaged plate served as an excellent holding power for the cement, and the whole job is considered as being very strong and effective, Lloyd's surveyor passing same to allow the vessel to steam between any ports without docking.

Oil Tanker Fulgor

THERE was recently launched by the "Cantieri Navali della Spezia," Spezia, Italy, the tanker *Fulgor* built to the order of the Società Marittima "La Columbia," Genoa, Italy. This tanker is intended to carry oil in bulk between the different ports of the North American Atlantic coast, the Mexican Gulf and also the Black Sea ports, supplying Italian and African ports on the Mediterranean coasts.

The principal dimensions of the vessel, built on the Isherwood system, are as follows:

Length between perpendiculars	401 feet 11 inches
Breadth extreme	54 feet 9 inches
Depth molded	31 feet 3 inches
Gross tonnage	about 6,500 tons
Load deadweight	9,000 tons

The propelling machinery, main and donkey boilers and auxiliary machinery have been supplied by Messrs. McKie & Baxter, Govan, Glasgow.

The propelling machinery consists of one set of quadruple expansion engines, balanced on the Schlick-Tweedy system, with cylinders 21 inches, 29½ inches, 43 inches and 62 inches diameter with a stroke of 45 inches designed to develop about 2,000 indicated horsepower to give the vessel a sea speed of 10 knots.

Steam is supplied by three single ended Scotch boilers fitted to burn either coal or oil, with Howdens forced draft and White low pressure oil fuel system. Steam for the deck machinery is supplied by one single ended Scotch boiler also fitted to burn either coal or oil.

The following auxiliaries are provided: one steering gear, by Donkin & Company, Ltd., Newcastle, one windlass with capstan, two winches, two main petroleum pumps, two auxiliary oil fuel transfer pumps, two dynamos, one Hall's refrigerator, two evaporators, one fresh water distiller and all other auxiliaries for the main engine.

A sister ship of the *Fulgor*, named *Vigor*, is also being built at the same yard.

The Shipping Board announced on March 9 that it has fixed a minimum price of $30 a ton for its ships as representing the world market price and has sold a number of ships at this figure.

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Deck Coverings—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

COMPOSITION deck covering when well made is not subject to as much expansion and contraction as cement deck covering. It is the practice on large surfaces to insert expansion joints about 30 feet apart, filling them with an asphalt of high melting point.

Expansion and Contraction

There are three types of expansion and contraction effects —the first, that due to expansion with heat and contraction with cold, the second, that due to setting reactions, and the third, that due to aging or storing conditions, humidity, etc. The first of these is very small, but expansion and contraction due to the other causes is sometimes comparatively very great and leads to grave trouble in many cases.

The majority of the expansion or contraction effects of composition deck covering usually occur during the period between final set and 24 hours old. Some products show an expansion of .3 percent in this early period and some a contraction of like amount. With the latter cracking is sure to occur and the former will often cause buckling.

All composition deck covering of the usual mix will expand in moist air or when wet, regardless of the type of magnesite used, but it will not always contract in absolutely dry air.

Some magnesites expand when stored in normal air and some contract. Both the chemical composition and the burning temperature influence the expansion and contraction, but this influence has not been clearly defined. It is unfortunate that commercial magnesites vary as much in this respect as they do, for there is little doubt that much of the trouble encountered by deck covering manufacturers is traceable to this cause.

Excessive amounts of chloride increase expansion effects.

As is the case with strength and wearing resistance, the amount of expansion or shrinkage is dependent upon the strength of the chloride solution used. With expanding magnesites the 22-degree solution is the one productive of the best results, while shrinking magnesites admit of greater solution strengths.

Kieselguhr, Celite, precipitated chalk, volcanic ash and other materials which are of an impalpable fineness, when used in place of silex, are almost certain to give a cement having an excessive tendency toward shrinkage and cracking. Such aggregate absorbs a larger volume of solution and this in drying out during setting produces a change in the volume of the mass. This nullifies the value of the increased covering power sought for and made possible by the use of Kieselguhr and similar materials.

Watertightness

Properly made composition deck covering when intact is practically watertight. Tests on a sample one-half inch thick, as reported by one of the leading exponents of this type of decking in the April, 1918, issue of this magazine, showed a water absorption of less than 2 percent of the original weight after the sample had been submerged for four weeks. Although this type of deck covering as at present developed is essentially an interior one and not suitable for continuous wetting, it is important that it allow of frequent washing without disintegration, that it be unaffected by water standing on it for a reasonable length of time and that it shall not allow water to penetrate to the steel deck beneath it.

The principal factor in securing watertight qualities is proper grading. Some commercial products are so porous, due to improperly graded aggregates, as to allow of seepage of water through them.

The use of too great an amount of water absorbent aggregate, such as soft wood sawdust or flour, impairs the watertight properties.

There are various solutions on the market designed for integral waterproofing, which are of some value. They are, however, not necessary for the customary service of a properly made composition deck covering and cannot be expected to make up for the defects of an improperly made one.

Setting Time

Magnesium oxychloride cements are subject to two sets, an initial set and a final set. After the composition deck covering is mixed, dumped upon the deck and leveled off, the workmen have to wait for the initial set to allow them to move about on it without displacing it for the purpose of surface trowelling. When final set takes place no more trowelling can be done and, if it takes place too soon, the surface has to be finished off as well as it can be by the use of wire wool. There should manifestly be a reasonable time, depending upon the size of the job, between the mixing of the materials and the initial set and at least two hours between the initial set and the final set. With a properly made composition both times are ample and there will usually be about six hours between the mixing and final set in the hot summer months, increasing to about 48 hours in cold winter weather. Composition does not freeze at a temperature higher than 50 degrees below zero; so there is no interruption of operations on that score.

The setting time increases rapidly with decrease of temperature below the normal and decreases very materially with increase of temperature above the normal. The Dow Chemical Company has prepared a curve to show directly the setting time of any oxychloride flooring at any temperature, if its setting time at the normal temperature, i. e., 60 to 70 degrees, is known. This curve shows the setting time at 35 degrees temperature to be about 3½ times that at 70 degrees, and the setting time at 100 degrees to be slightly over one-half that at 70 degrees.

The Dow Company has also prepared curves for use in estimating the effect of chloride solution strength on the setting time, provided the setting time with the use of any definite strength of solution is known, other factors remaining the same. These show for deck covering mixtures an increase in the time after mixing the material required for both initial and final set as the chloride solution is increased from 16 to 26 degrees Baumé, and show that the time between the two

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

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sets is a minimum with the 20-degree solution, increasing both ways from that point. They have found that the setting time of an oxychloride cement will average 10 percent faster when made up with 18-degree solution and 10 percent slower with a 26-degree solution, than when a 22-degree solution is used.

The initial set is but little affected, though in some cases hastened by damp air, but the final set is slower in such air. Eight samples of flooring mix tested by the Dow Company in 1920 showed an average of only about 12 minutes increase in the interval between initial and final set with moist air as against normal air when mixed with 18-degree magnesium chloride to normal consistency at normal temperature and about 30 minutes increase in the interval between initial and final set with 22-degree solution.

Both initial and final set occur later as the stiffness of the mixture is decreased from the normal value. The writer has no data for deck covering mixtures to show clearly whether the elapsed time between the two settings is increased or decreased as the product is thinned.

The greater the amount of magnesite, the earlier will be the initial and final sets; but no appreciable gain in the interval between the two sets can be obtained by varying either way from the normal amount.

Magnesite that is underburned sets earlier and magnesite that is overburned sets later, in the composition, than the normal. Many commercial magnesites are far too rapid setting for use in hot weather. Twelve samples of a number of different commercial magnesites made up into a deck covering mixed to normal consistency with 22-degree solution were found by the Dow Company to have initial sets in from 1½ to 6¾ hours, final sets in from 3 to 9¼ hours, and differences between initial and final sets of from 1¼ to 2½ hours. These results show the lack of uniformity in commercial magnesite and the necessity for careful physical tests of the magnesite shipments. Specifications calling for a minimum setting time at a particular temperature would be of great value.

Calcium chloride and sulphates as impurities in the magnesium chloride will somewhat increase the time between initial and final set. These with salt constitute the impurities for which the magnesium chloride is usually tested. The salt has no effect on the setting time.

Color

Uniform and permanent colors can be obtained in Venetian red, dark red, brown, tan, yellow, gray green, light gray, dark gray, white and black. The first mentioned is the most usual probably because being the easiest with which to obtain lastingly good results; and it is a good, warm color for shipboard use. Blue is not apt to be permanent, being affected by any weak acid that might come in contact with it; and a true green, unless made with very expensive material, will in time be changed to yellow.

Thorough mixing is of course a factor in color uniformity.

The Dow Company suggests improving the color uniformity by suitably coloring the fibrous aggregate used; but aniline colors are apt to change color when the magnesium chloride solution strikes them and oil colors will gum the fibers together. Perhaps, however, something of this kind can be worked out.

The surfacing tools used sometimes mar the color. Iron trowels are blackened by the chloride solution and frequently smear the surface when first used on later work. Brass and copper trowels produce a green discoloration from the same cause. This trouble may be eliminated by the use of bronze trowels.

Sweating and Efflorescence

Sweating of the composition deck covering results principally from an excess of magnesium chloride solution, which absorbs the moisture from the air. It depends to some extent upon the nature of the magnesite used. Some magnesites are hard and sandy in texture even though finely ground while others are soft and velvety. The former have a tendency to allow the solution to work to the surface during trowelling while the latter hold it uniformly in the mass. An excess of surface chloride combines with the other surface material to form a compound which is very hygroscopic. Underburned magnesites combine with much less chloride than do properly burned magnesites, and may on that account give rise to sweating troubles.

Efflorescence is principally a result of the sodium chloride, or salt, which occurs as an impurity in the magnesium chloride, and less than .2 percent of salt will cause it. It is increased by heat. If it is not washed off as it appears it has a tendency to fade the color of the deck covering. Efflorescence is only a temporary trouble and a flooring that is kept clean soon loses this undesirable property.

Surfacing

The surface finishing of a composition deck covering is a very important factor in a successful installation, and necessitates the maintenance of a field organization of workmen who are skilled in the art.

The use of fine fibers and wood flours is an aid to ease of trowelling and the uniform appearance of the deck covering. The value of trowelling as an aid to wearing qualities and the reduced wear resulting from the use of wood flour instead of sawdust have been previously referred to.

Cork as an aggregate has a tendency to cause roughening and pitting of the surface under traffic. It has been tried out in various forms by some of the deck covering manufacturers, and abandoned.

Imperfect mixing results in surface pitting.

Thickness of Coating

The properties of a composition deck covering, among which are relatively slight toughness and some expansion and contraction, demand a minimum thickness over buttlaps or other high spots of ¾ inch. The thickness of 1½ inches which is usually specified for shipyard work will in most cases allow of this. The average thickness of such a covering will be about 1⅛ inches, and the weight may be approximately figured as 7¾ pounds per square foot.

Specifications

The writer has not seen any specifications for composition deck covering that properly protect the user of it, and this is probably because any batch of material cannot be properly tested out prior to being put down and because the test of a previously prepared sample or of a part of another batch will not give the answer. It is probable that most of the technical points which we have been considering will have to be taken care of by the manufacturers in specifications for the purchase of their materials, and the writer understands that the National Association of Oxychloride Cement Manufacturers is about to undertake the preparation of revised and uniform specifications of this nature. The following requirements can however be very well embodied in specifications for the completed product:

1. The application of an approved bituminous solution directly on the steel.
2. Pure ingredients of the nature required for a magnesium oxychloride cement, properly graded.
3. Uniform and permanent color.
4. Thorough mixing of the ingredients.
5. Use of magnesium chloride solution strength not less than 22 degrees Baumé.
6. A consistency of mix that will support on end a 1-1/4 inch diameter blunt ended rod weighing 250 grams.
7. An approved method of binding the covering to the deck.
8. A normal thickness of 1-1/2 inches or more, as desired, with a minimum thickness at any spot of 3/4 inch.
9. A thoroughly trowelled, smooth surface.
10. A guarantee for one year against excessive wear and cracks.

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The guarantee does not protect the ship from loss on account of being delayed while the covering is being renewed, but is of value when furnished by a reliable manufacturer.

CONGOLEUM

See "Felt Base Deck Covering."

CORK COMPOSITION TILING

This is an interior deck covering made of powdered cork, wood flour, linseed oil, gums and pigments, in a manner similar to linoleum and cut into tiles which finish about ¼ inch thick, interlocking or otherwise.

It is quiet, warm, elastic and non-slippery to the tread, has good wearing qualities and allows of pleasing artistic effects. It is used in the same locations as rubber tiling. This tiling ¼ inch thick weighs about 1½ pounds per square foot. It is cheaper and lighter than rubber tiling.

The materials should be clean and pure and thoroughly mixed so that the tile is homogeneous throughout.

The sheets should be seasoned in drying rooms for at least three months before the tiles are cut. The edges should be cut clean and square, and the tile be true to size, as otherwise the covering could not be laid watertight.

The tiles are fastened to the backing with waterproof cement and should be serrated on the under side to insure a proper bond with the backing. They can be laid direct on wood or cement. Steel decks are preferably leveled off with a special cement or composition as Portland cement will crack under this tiling unless it is several inches thick. A coating of bituminous solution under composition is desirable.

DREADNAUGHT TILING

See "Cork Composition Tiling."

DURAFLEX

See "Mastic."

EVERLASTIC TILE DECKING

See "Cork Composition Tiling."

FELT BASE DECK COVERING

This deck covering is a substitute for linoleum. It is proposed by its manufacturers for use in the same locations and is laid in the same manner. It is an asphalt saturated felt base material, and, if a poor asphalt is used, the product will be poor. The following specifications have been prepared by one of the manufacturers as embodying requirements which will ensure good quality.

Base Material and Seasoning. The base of this material is to be manufactured of a good grade of rag stock well beaten and formed into a sheet and then staurated with compound petroleum asphaltum. This saturated sheet shall then be well seasoned before the application of any surfacing material.

Surface Material. The surface of this material shall be manufactured of the best grade of linseed oil, gums, pigments, and colors. It shall be well baked and thoroughly seasoned before inspection and shipment.

Uniformity of Color and Grain. When this material is cleanly cut at an angle of 45 degrees, it shall show no material difference in color or grain between the edges and center in either the base or the surface.

Weight and Thickness. The thickness of the base of this material shall be measured on a spring micrometer thickness gage, and shall gage between 63/1000 inch and 67/1000 inch. The surface of this material shall also be gaged on a spring micrometer thickness gage and same shall gage between 26/1000 inch and 29/1000 inch. This material finished shall weigh five pounds to the square yard and shall have a total thickness of from 90/1000 inch to 96/1000 inch.

Backing. The back of this material shall be well covered with a coating of linseed oil and pigments.

Tests for Quality. This material shall be made to withstand the following tests after it has been kept at a temperature of 70 degrees F. for a sufficient length of time so that the whole body has reached this temperature.

Bending Test. A strip 2 inches wide with backing on inside of curve shall bend, without showing the slightest signs of cracking, around a bar two inches in diameter. At least one strip shall be cut longitudinally and one strip transversely of the roll.

Indentation Test. This is the same as required by the Navy Department for linoleum and given later under that head.

Absorption Test. A sample 6 inches by 3 inches shall be weighed and then submerged for 24 hours in fresh water at a temperature of 70 degrees F. The sample at the end of this period shall be removed from the water and the surfaces, including edges, dried between blotter or filter paper. At the end of 2 minutes from the time the test piece has been removed from the water it shall be weighed again. The increase of weight shall not be more than 5½ percent.

Number of Tests. When inspected at the factory, at least one complete set of tests shall be made on each lot, a lot being defined as material submitted for inspection at one time, made of the same quality and proportions of saturating material and coloring matter, calendered and seasoned at the same time and under the same conditions. In no case, except in the delivery of a single roll, shall less than two sets of tests be made.

INSULITE MINERAL RUBBER FLOORING

See "Mastic."

J. M. ASPHALT FLOORING

See "Bitumen Deck Coverings." Class (b) Trinidad asphalt is used.

KOMPOLITH

See "Composition."

LEAD

Sheet lead should be used on wood decks under the entire cement floors of wash rooms and toilets, extending up the side walls about 9 inches above any other deck covering. Sheet lead around a room extending up on the walls in this manner and a short distance out on the floor is called a flashing; and lead flashings should be run generally around toilet and wash rooms which are not tiled, refrigerated rooms and other spaces on the floors of which water is apt to collect. Lead is sometimes used on the floors of wash rooms with no other covering except a wood grating.

Sheet Lead for these purposes should be about ⅛ inch thick, which weighs 7.4 pounds per square foot.

LINOLEUM

Linoleum is an interior deck covering and the nature and properties of the inlaid, or so called "Battleship," linoleum are similar to those of cork composition tiling. It is of value for the wheel house, chart room, living quarters and passageways. Navy Department specifications for this material embody the following requirements:

Material and Seasoning. To be manufactured from the best grades of linseed oil, driers, gums, cork and coloring matter. An admixture of wood flour is not objectionable, provided that the requirements of these specifications are met. It shall be thoroughly seasoned before being offered for inspection or before being shipped.

Uniformity of Color and Grain. Surface cleanly and freshly cut at an angle of 45 degrees shall show no material difference in color or grain between the outer edges and the center. To be terra-cotta red ground body throughout.

Cork. The cork shall be clean, thoroughly ground, and of such size that when ready for use it will pass through a screen not coarser than 22-mesh.

Burlap Backing. The linoleum compound to be provided with a burlap backing of the best quality of hard-spun yarn weighing not less than 8 ounces or more than 11 ounces per 36 inches by 40 inches. The burlap to be deeply imbedded and keyed to the cork compound so as to be partially concealed in same. The burlap shall not be painted.

Weight and Thickness. Thickness shall be measured over the burlap on a spring micrometer thickness gage. The grades of linoleum shall be known as "Heavy," "Medium" and "Light," and shall conform to the following:

	Thickness in inches		Weight per square yard in pounds
	Minimum	Maximum	Minimum
Heavy	0.243	0.265	9½
Medium	0.185	0.201	7
Light	0.125	0.142	5

Tests For Quality. Linoleum shall withstand the following tests after it has been kept at a temperature of about 70 degrees

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F. for a sufficient length of time so that the whole body of the linoleum has reached this temperature.

Bending Test. A strip 2 inches wide with burlap on inside of curve shall bend, without showing the slightest sign of cracking, around a bar 3 inches in diameter for heavy, 2½ inches in diameter for medium and 2 inches in diameter for light weight linoleum. At least one strip shall be cut longitudinally and one transversely of the roll.

Indentation Test. Sample disks, 1 inch in diameter, shall be cut from the delivery and prepared by removing the backing and then buffing so that the under surface is absolutely smooth and parallel to the upper surface. A pressure of 80 pounds shall then be applied to the upper surface of the disks for a period of 60 seconds by means of a flat cylindrical steel bar 0.282 inch in diameter. The bar shall be supported in a frame in such a way as to insure the face of its foot being parallel to the surface of the linoleum. The edges of the face by means of which the pressure is applied shall be buffed smooth to prevent cutting the linoleum. The load shall be lowered gently until its entire weight presses upon the linoleum, but in no case shall the load be dropped upon the linoleum. One hour after the test has been made, the depth of the indentation shall not exceed 0.010 inch. If the depth exceeds this amount, the material shall be rejected. The surface of the material shall show no sign of being broken through or cut and, if such condition exist, even though the depth of the indentation does not exceed 0.010 inch, the material shall be rejected.

Burlap Test. Two-inch strips of linoleum shall be taken, one in the direction of warp and one in the direction of filling, and broken about 1 inch from the end by cutting part way through from the face and bending back. The burlap backing shall then be stripped slowly from the remainder of the test pieces by pulling at right angles to the back. The pull required shall not be less than 6 pounds.

Absorption Test. A sample 6 inches by 3 inches, prepared by removing backing and sandpapering or buffing the rough surface from which the backing is removed until the surface is absolutely smooth, shall be weighed and then submerged for 24 hours in fresh water at a temperature of 70 degrees F. The sample at the end of this period shall be removed from the water and the surfaces, including edges, dried between blotter or filter paper. At the end of 2 minutes from the time the test piece has been removed from the water it shall be weighed again. The increase of weight shall not be more than that indicated in the following table:

Linoleum	Allowable increase of weight
Heavy	3½ percent
Medium	5½ percent
Light	7½ percent

The wear resisting qualities of inlaid linoleum as well as the very inferior nature of painted linoleums are illustrated by the wear resistance table in the section on "Composition."

When laying linoleum all inequalities should be filled up with a special cement and the deck and the underside of the linoleum coated with linoleum cement.

Linotile

See "Cork Composition Tiling."

Linotol

See "Composition."

Litosilo

See "Composition."

Maple

This is an attractive deck covering that is of value on shipboard for public rooms of the nature of social halls. Its good wearing qualities are shown in the table in the section on "Composition."

Maple decking should be quarter sawed, ⅜ inch by 1½ inch, and be laid over a substantial wood deck with a layer of parchment sheathing paper between.

Marbleloid

See "Composition."

Maritimo

See "Bitumen Deck Covering." Special.

Mastic

The name Mastic is usually applied to a deck covering that is made by dissolving Elaterite by a volatile oil in sealed containers and adding asbestos fiber. Elaterite is a mineral rubber found in Utah which is almost pure bitumen and has a melting point of about 300 degrees F. The more volatile the oil the better, hence naptha is generally used. When applied to a deck the naptha evaporates, leaving a firmly adherent coating that contains no material soluble in water or acids, nor anything injurious to steel.

Mastic is resilient, waterproof, sanitary, durable and of light weight. A proper installation will not crack or come loose from the deck plates. If it is scarred or otherwise damaged it is very readily repaired; and holes can be cut in it or work done to steel or woodwork beneath it without injury which cannot readily be made good. Worn spots can be patched and the patches made indistinguishable from the original. It is much preferable to cement for living quarters, such as for the ship's personnel, where the cost of composition might not be warranted. The colors most readily available are black, green and dark red. An effort to obtain other colors would probably be at the expense of some of the good qualities of the coating.

For a substantial coating there should be a minimum thickness of at least ⅛ inch which for best results requires four coats. The naptha will not evaporate properly from a coat much over 1/32 inch thick and an attempt to lay thick coats results in a covering which will harden on the surface and be soft underneath, thus becoming dented and uneven. Inequalities in the surface to be covered, such as plating laps, are taken care of by previously prepared wedges of the material or some other material such as composition which will not crack or have a tendency to creep in hot weather.

This deck covering will weigh from 2 to 3 pounds per square foot, depending upon the inequalities in the surface to be covered.

The chief disadvantage of Mastic is the fire hazard due to the evaporating of the naptha while the material is being laid. A light of any kind or even a hot rivet will start a fire. There is no danger after the covering has hardened. This objection could be overcome by the use of tetrachloride of carbon instead of naptha to dissolve the Elaterite, but that material is very expensive. It can be said in this connection that while some shipyards will not use Mastic on account of the fire hazard, it was used during the rush work of the war on a great many steamships without any fire casualty as far as known to the writer.

In laying Mastic on a steel deck a coat of liquid gum solution is applied, the triangular filling pieces at the laps and butts are laid in it, and the first body coat of Mastic is put on with a trowel in a plastic state and then rolled, without any waiting between these operations. Other body coats and the finish coat are laid on subsequent days, one a day. Sometimes two finish coats are required. The body coats get hard enough to walk on in about 12 hours, and the finish coats, which have the color in them, in about 24 hours, though this depends somewhat upon weather conditions.

Mastic is laid on wood and concrete decks in the same way except for the absence of filling material to level up these decks.

Neuchatel

See "Bitumen Deck Covering," Class (b).

Penco

See "Composition."

Rubber Tiling

This is an ideal deck covering for dining saloons, smoking rooms, lobbies, passageways in passenger accommodations, stair treads and similar service. It has the well known quiet, resilient, non-slippery and waterproof properties of rubber, and admits of artistic design and coloring. The tiles are made interlocking or otherwise, about ⅜ inch thick, and are cemented down. They are usually made up in sections 2½ feet square for convenience in laying, composed of a number

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of the tiles locked together in the desired pattern. The backing has been referred to in connection with cork composition tiling.

Rubber tiling is more expensive and heavier than cork composition tiling but on the other hand it is more waterproof and sanitary and has a cleaner appearance. The weight is about 4½ pounds per square foot.

TENAX

See "Bitumen Deck Covering," Class (b).

TILE

The two classes of tile which are of particular interest for shipbuilding purposes are—

(a) Wall tile
(b) Floor tile

Both are usually ceramic, or pottery tile, made of powdered clays which are subjected to great pressure and fired. They are given an uneven back surface for better adhesion to the backing material.

The wall tiles are mostly made of white-burning clays and flint and are porous and of moderate hardness after being burned. These tiles are, however, subsequently dipped in a glazing mixture and fired a second time, which develops a hard, waterproof surface that is very sanitary and easily kept clean.

The floor tiles, with which we are principally concerned, should not be glazed, as that makes them slippery. In addition to being non-slippery they should have good resistance to abrasion and be dense enough to prevent the absorption of dirt and moisture. Vitrified, but unglazed, ceramic tile has these properties and because of this and its harmony with the glazed wall tile it is usually found in the high grade toilet and wash room construction which calls for glazed tile on the walls. It also makes a high grade flooring for cold storage rooms. The color is preferably white or cream. The high wearing value is shown in the table under "Composition."

Encaustic tiles are those which have the main body of one color of clay and patterns laid in other colors of clay before firing. Ceramic tiles are often called mosaic tiles, the latter word having reference to patterns made by the use of tiles of different colors.

Brick tiles have been previously dealt with.

There are various special makes of floor tile, some of which are designed to be particularly non-slippery and wear resistant.

Tiling is laid in Portland cement backing which should have expanded metal or similar reinforcing in it. The cement should be at least 1¼ inch thick and the tiling be laid and grouted just after the cement is laid and before it has reached its initial set.

The Most Interesting Job in the Yard

Another spokesman for the ship designers, or ship draftsmen, has something to say this month as to why their work is the most interesting in the yard. How about YOUR job? How does it compare with the others discussed under the above heading? Tell us about it.

ALL of us who work find, at least spasmodically, something absorbingly interesting in our task but to only a few of us is it given to discover a sustaining interest before we have reached that period in life when we are expecting time to knock at the door and say that our years of usefulness are at an end. At that moment, how many intelligent people are ready to lay down their work? How many of them do not feel that just then they are prepared to accomplish something really worth while? The years that have oozed away were spent in the daily struggle for the daily bread, or wasted in vain pursuits and endeavors, but, now, when old age has robbed them of their strength they eagerly desire to accomplish something more lasting, to do something creative. And never did work seem so alluringly tempting, so intensely interesting as do these creative tasks of the future that must be left to someone else to do or that must go undone.

That is the key to interest in work, the doing of something creative whether it be in the field, in the shop or in the office, and the lack of interest, with the consequent "labor unrest," is usually traceable to the inability of the worker to see the creative value of the task assigned to him. Of all the tasks that are necessary for the creation of any of the multitudes of products of modern industry, those which are most inclusive, which most completely survey the entire process of manufacture or creation, necessarily have the strongest and most lasting hold on the interest. And what task is more inclusive than that of the designer who follows the entire process from the first conception to the last polishing touch of completion? And what designer has a wider, a more inclusive range of interest than the designer of ships—even though he be only a "scrub draftsman" to whom it is given to see, in the plans he handles, the seed of a floating, moving, living ship? To be sure, some people succeed in taking an interest in fields of work where no finished results are ever visible, but I am inclined to believe that their interest is forced, that it is sustained by their determination to shut out from their consciousness every feeling of incompleteness, every suspicion of disappointment or of lagging of interest because the results of their efforts are not satisfying to themselves.

Admittedly, there may be a gambling interest in work—the interest of the financier who plays the game and takes his losses as well as his gains. No doubt there is also a touch of romance in such activities, as, for example, in the financing of the manufacture of a product that is sent over the seven seas to the four corners of the earth. But I sometimes wonder why the really successful financiers so often turn to philanthropy. The moralist may mutter something about the compunctions of conscience, but is it not possible that the building of libraries and colleges and hospitals is at bottom nothing but the fulfillment of a desire to do something more lasting than the hoarding of wealth, to accomplish or take part in something creative, to see something grow—other than the figures on the credit side of the ledger? If this postscript of creative work really is, though perhaps unconsciously, intended to satisfy an inborn desire for useful labor, then the whole of the previous career must be regarded as but a preparation for the creative work and purely financial success is then measurable only by the extent to which it makes creative work possible. But without this long period of preparation, it is possible for all of us to do useful, creative work, work that is necessary for the making of a finished product.

And when the finished product is a ship, with the relative lack of repetition usually met with in ship work, the appeal

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is even greater than with most things that ordinarily come under the head of finished products—and all the more so when your share of the building is that of a draftsman. There was the first, rough, preliminary design, perhaps preceded by a study of service conditions. Follows then that fascinating game of give and take, the aim of which is to satisfy all concerned as far as possible, and which is ordinarily known as chosing the lesser of two evils. And that is a game continued until the ship is delivered and you heave a sigh of relief, for way back in the dawn of the history of this contract there was the estimate, which has been hanging over your head like the sword of Damocles, that document of figures covering a score or more of trades in steel work alone, covering steam and electrical engineering, piping and plumbing and wiring, carpentry and joiner work, rigging and equipment, painting and cementing. Although not, to be sure, master of all these trades, the draftsman, when he also officiates as estimator, makes prodigal use of detailed cost figures pertaining to them all, not to mention overhead costs, only to find it a rather painful performance to work within the estimate when the day of reckoning has come.

Not that his life is made up of estimating and days of reckoning only. There are many days of growth, growth of plans and material piles in the yard, growth of the ship's structure from the time the keel blocks are lined up and the keel is laid until the day when the vessel gracefully slides down the ways amid the blowing of whistles—yes, growth even until her rigging is set up and the first smoke is starting to curl up from her stack. Did you ever watch the floors and frames go up from day to day? Did you ever see the shell plating grow and gradually envelop that skeleton we call the framing of the ship, just as the spring foliage gradually envelops the twisted skeletons of trees and shrubs? If you have seen these things, and if you have had any part in the growth of a ship, you know the feeling and the interest that observing this development produces.

And the interest does not end even when the ship, the curl of smoke changed into a long, thin streamer, speeds away from the yard. So long as that ship floats and sails the seas your thoughts are more or less with it—sympathetic thoughts, which make you feel that this thing of steel and iron that you have helped develop from a mere conception is almost a living thing that carries with it something of your personality, for is not part of yourself woven into it?

And again, there is the larger view, the broader interest: each ship you help build becomes a unit of a fleet, be it merchant or naval, destined not merely to do its share of the world's work for the term of its life but also to be a foundation for the ships of the future, for better ships and safer ships, if not for larger ships, and to add its mite to the store of general knowledge and skill that makes the advancement of the world possible.

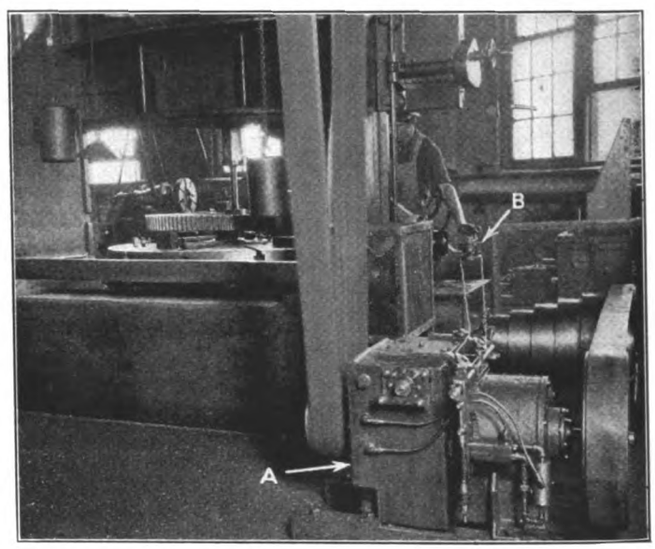
Quincy, Mass. JOHN FLODIN.

Oil Pressure Power Transmission Applied to Machine Tool Operation

IN applying variable speed, oil pressure, power transmission devices to machine tools the Oilgear Company, Milwaukee, Wis., has developed a feed control and a variable speed drive to eliminate the manual work of controlling medium and heavy machine tools. The feed control system consists essentially of a pump which may be adjusted through a wide range of delivery capacity and a motor driven by the oil received from the pump. The pump is ordinarily driven from the countershaft of the machine tool on which the control is applied and the motor attached to the carriage or ram on which the feed is desired.

Two types of feeding motors are employed: the direct acting pushing cylinder and the rotary motor, the former being used when space conditions permit. For very long machines and frequently for cross feeds where it is necessary to have a screw control of the tool slide, the rotary type of motor is used. A feature of the feed gear, is the rapid traverse movement obtainable which enables the operator to move heavy carriages and rams without fatigue. The feed control permits the operator to increase the feed when cuts become lighter, back out the tool for examination of the cutting edge and return it quickly into the cut without disconnecting the friction clutches, etc.

Delivery of fluid from the feed controller, varied in quantity and direction, compels the feeding motor to perform exactly the function desired by the operator. The pressure in the system is large or small according to the resistance offered to the cutting tool, but the feed motor moves at the exact rate of speed called for by the operator without regard to the pressure required to do the work. If this pressure rises above the maximum necessary for feeding, a relief valve



Rear View of 7-Ft. Boring Mill Equipped with Oilgear Variable Speed Drive

opens and permits the feed motor to come to a standstill. This property is made use of in locating shoulders and the like in work to be machined as it is only necessary to set rigid stops and allow carriage to run against them as desired.

In addition to its use on lathes and the like, the variable delivery pump may be applied to presses and boring mills. An example of this is given in the accompanying illustration, where the device is shown applied to a 7-foot boring mill. This machine is driven by the standard feed controller requiring only a belt drive from a line shaft.

A larger type machine, designed to drive the spindles of machine tools from a line shaft, a constant speed electric motor or a gasoline engine has also been developed by the Oilgear Company. The principle of operation is similar to that of the feed control system, securing for the operator a wide range of speed changes in either direction through the manipulation of a single control handle.

JAPANESE SHIPBUILDING.—At the present time there are 14 Japanese shipbuilding establishments capable of constructing ocean-going merchant ships as compared with a total of 53 yards in 1918. Of these 14 plants only nine are actually engaged in new construction. The estimated output of the Japanese yards for 1921 was 40 vessels aggregating 190,000 gross tons. The maximum output occurred in 1919 when 136 vessels, totalling 621,513 gross tons were built.

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The Still Engine

By L. B. Chapman*

This is a combination Diesel and steam engine, devised to increase the thermal efficiency over that of the Diesel engine. The heat ordinarily rejected in the jacket water and to the exhaust is used to produce steam and about 8 percent of this heat is converted into useful work, increasing the brake horsepower of the engine about 30 percent.

FROM the diagram of the Still engine shown in Fig. 1 it will be seen that in its present form the engine is double acting with the Diesel cycle working on top of the piston and the steam cycle below the piston. The water jacket is connected in a circuit with the boiler and an exhaust generator as shown in the diagram. The cooling water enters and leaves the jacket at a constant temperature corresponding to the pressure of the steam in the boiler. The heat absorbed by the jacket water surrounding the combustion cylinder is used to convert the water into steam

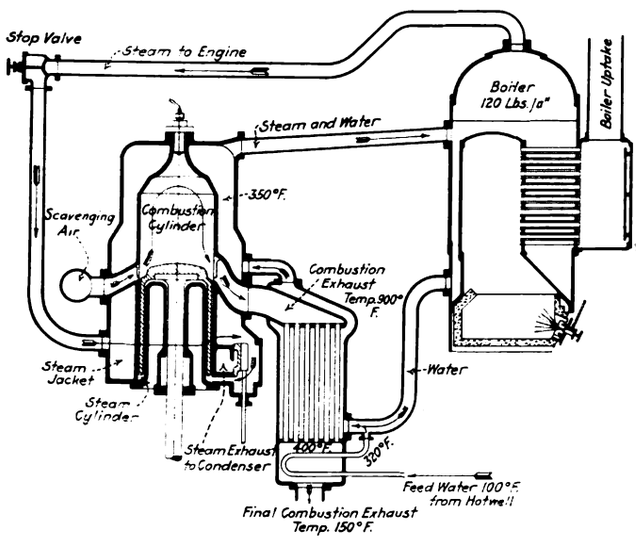

Fig. 1

at constant temperature. In other words, the heat of combustion that radiates through the walls is transferred into latent heat of steam. The steam thus generated passes to the boiler. The function of the boiler is to produce steam for warming up and starting the engine and to augment the supply generated in the jackets, if the jacket supply is not sufficient for the steam end of the cylinder.

The boiler feed water is circulated through the jacket as shown in Fig. 1. The feed water is taken from the feed tank by the feed pump as in all steam plants and is delivered at about 100 degrees to a feed heater or exhaust generator where it absorbs the heat in the exhaust gases. The temperature of the feed water is thus raised from 100 degrees F. to between 350 and 450 degrees F. and the exhaust gases are reduced from 900 to 150 degrees F. The feed water then enters the jacket where it is converted into steam by the heat of combustion.

The steam from the boiler enters the lower part of the cylinder and acts on the piston in practically the same manner as in a steam engine and is then exhausted to the condenser. Cylinder condensation, which is a large loss with the ordinary steam engine, is practically eliminated in the Still engine because of the heat received from the combustion of the gases in the Diesel end.

During compression of the air on the Diesel side of the piston the air charge absorbs heat from the cylinder walls because of the high temperature in the jacket. With the straight Diesel engine the transfer is in the opposite direction, due to the cold circulating water. One result of this is that the required compression pressure is less in the Still engine than in ordinary Diesel engines.

Advantages of Combined Cycles

The advantages due to the interaction of the combustion and steam cycles are summarized by Mr. F. E. D. Acland in a paper before the Royal Society of Arts as follows:

1. The mean temperature of the cylinder walls is higher than in ordinary engines; the cooler parts being maintained at a higher, the hotter parts at a lower, temperature.
2. The piston is cooler, owing to the expansion of the steam behind it.
3. The heat efficiency of the combustion cycle is augmented owing to the walls being at a higher and constant temperature, and is in proportion to the rise in temperature of the jacket water.
4. Frictional losses are reduced by the higher temperature, and by the steam overcoming the inertia of the reciprocating masses at the lower dead center.
5. The mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of similar type.
6. The steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine.
7. Twenty-nine percent of additional brake horsepower is added to the shaft of the engine without increase in the fuel consumption. (Steam not condensed.)
8. Forty percent is added when condenser is used. (Air pump separately driven.)
9. The indicated horsepower due to steam appears as brake horsepower added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion brake horsepower.

Besides the merits listed above the two-cycle Still engine has the following advantages:

1. Fuel consumption 10 to 20 percent lower than the Diesel engine.
2. Absence of cold circulating water causing large temperature difference and trouble with cylinder and head castings.
3. Absence of cylinder condensation in steam end.
4. Lower compression pressure.
5. Absence of air starting, circulating and piston cooling system.
6. Absence of exhaust valves and gear.
7. Increased horsepower for a given bore and stroke.
8. Possibility of overload by forcing steam boiler.
9. Maneuvering at low revolution per minute is possible.
10. High temperature range 2000 to 150 degrees F. (Carnot efficiency).

Trials with a single cylinder two-cycle Still engine were carried out during 1921 by Scott's Shipbuilding & Engineering Company, Greenock, Scotland. Owing to the fact that the experimental engine had only one cylinder, it was necessary to provide a small auxiliary high pressure steam cylinder, the lower end of the main Still cylinder serving as a low pressure steam cylinder. In an actual installation where several cylinders are used the lower part of one can

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be used as a high pressure cylinder and the lower part of another as a low pressure cylinder, thus obviating the use of an auxiliary cylinder. All the auxiliaries except the scavenging air pump were driven off the main engine in these trials.

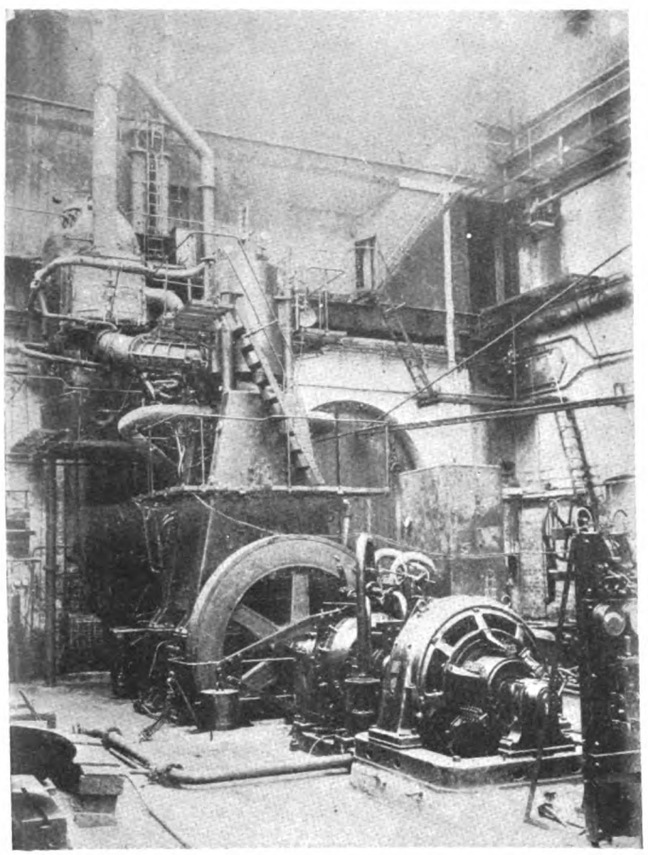

Fig. 2.—Still Engine Undergoing Shop Test

A photograph of this engine is shown in Fig. 2, and a diagrammatic view showing all the auxiliaries in Fig. 3.

The result of the trials of this engine are given in the following table:

Trials of 22-Inch by 36-Inch Still Oil Engine

Main Still cylinder—Stroke, 36 inches. Bore, 22 inches. Piston rod, 6¼ inches.

Auxiliary high pressure cylinder—Stroke, 14 inches. Bore, 22 inches.

		Over-load	Full Load	Half Load
1.	Average combustion M. E. P., lbs. per sq. in.	88.9	81.2	54.2
2.	Average steam M. E. P. referred to H. P..	4.43	3.80	1.26
3.	Average steam M. E. P. referred to L. P..	7.36	6.23	3.60
4.	Total M. E. P.	109.69	91.25	59.06
5.	R. P. M.	128.1	124.3	103
6.	Steam boiler pressure, lbs. per sq. in. gage.	112	100	108
7.	H. P. receiver pressure, lbs. per sq. in. gage.	75	57	23.5
8.	L. P. receiver pressure, lbs. per sq. in. gage	11	5.5	0.4
9.	Vacuum, inches Hg.	28	27.5	26.6
10.	Water evaporated per hour, lbs.	950	807	388
11.	Scavenging pressure, inches water.	49	46	40
12.	H. P. for scavenging.	15.4	14.1	12.0
13.	Combustion I. H. P.	394	349.5	192.5
14.	Total I. H. P.	446	392	210
15.	Engine B. H. P.	384	343	174.5
16.	Net B. H. P. (line 15—line 12).	368.6	329	162.5
17.	Oil per hour, lbs.	146.6	123.4	64.0
18.	Oil per net B. H. P. per hour.	.398	.375	.394
19.	Efficiency on net B. H. P., percent.	35.5	37.7	35.8

It will be observed that the fuel consumption at full load is 0.375 pound per brake horsepower, which is about 10 percent lower than the best four cycle Diesel practice and nearly 20 percent better than the general run of two cycle Diesel engines.

Claims are put forward that the Still engine weighs less and occupies less space than the Diesel engine. The gain in economy of between 10 and 15 percent for this single cylinder engine is highly encouraging and no doubt this can be improved upon when several cylinders are used. At first thought the engine appears complicated but it must be borne in mind that the air starting, circulating and piston cooling systems are eliminated and the small boiler employed with

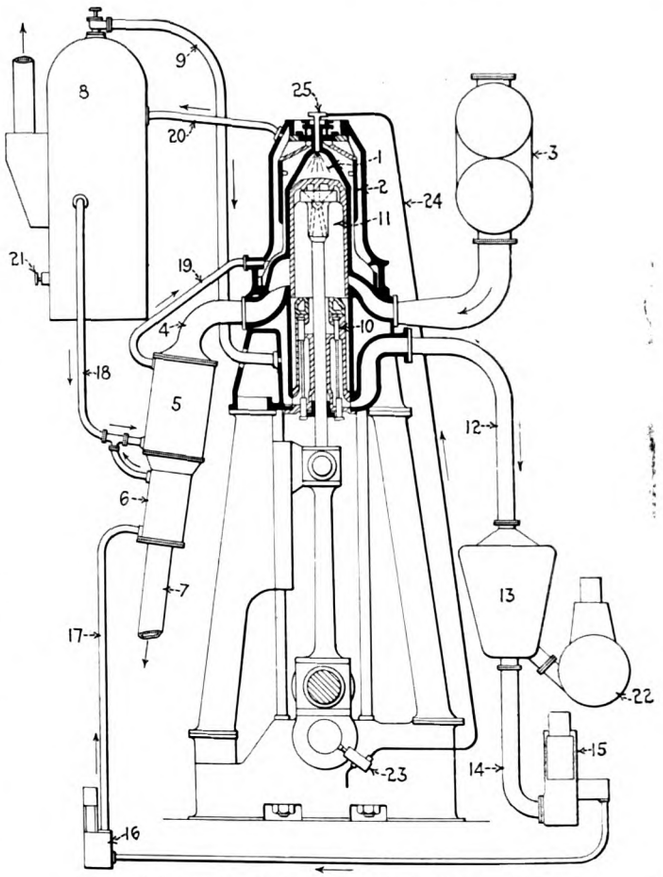

Fig. 3.—Section Through Still Engine

1. Combustion Cylinder.
2. Reinforcing Steel Hoop.
3. Scavenging Blower.
4. Combustion Exhaust Pipe Jacketed by Boiler Water.
5. Exhaust Generator.
6. Feed Water Heater.
7. Final Combustion Exhaust to Atmosphere.
8. Boiler.
9. Main Steam Pipe.
10. Steam Inlet and Exhaust Valves.
11. Steam Cylinder.
12. Steam Exhaust to Condenser.
13. Condenser.
14. Suction Pipe to Air Pump.
15. Air Pump.
16. Feed Pump.
17. Delivery Pipe to Feed Heater.
18. Circulating Water, Boiler to Exhaust Generator.
19. Circulating Water, Exhaust Generater to Cylinder Jacket.
20. Circulating Water and Steam; Jacket to Boiler.
21. Auxiliary Oil Burner.
22. Condenser Circulating Pump.
23. Oil Fuel Injection Pump.
24. Oil Fuel Delivery to Injection Valve.
25. Injection Valve.

the Still engine would generally be required on a Diesel ship for heating purposes.

It would seem that the claims of the inventor are borne out by the recent trials and the engine has excellent possibilities for marine propulsion. The diagrams, photograph and data in the above article were kindly supplied by the Still Engine Company, of London.

Munson Elected Member of Executive Committee of Merchant Marine Association.—Frank C. Munson, president of the Munson Steamship Lines, has been elected a member of the executive committee of the National Merchant Marine Association, according to an announcement by Senator Joseph E. Ransdell of Louisiana, president of the association. "Mr. Munson's election to the executive committee," says Senator Ransdell, "is very important, as he brings to it long practical experience in steamship management, both as owner and as operator of United States Shipping Board vessels."

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Weight of Speaking Tubes on Warships

Q. (1156).—Can you give me an idea of the weight devoted to speaking tubes on a war vessel?

A. (1156).—During recent years the necessity of prompt communication between various parts of a vessel has been emphasized. The effect in terms of weight in the case of war vessels is apparent from the figures given below for brass voice tubing and fittings:

	Tubing	*Fittings*
Battleship	56,000 pounds	19,000 pounds
Scout	10,500 pounds	3,500 pounds
Destroyer	7,250 pounds	1,950 pounds

Point of Maximum Valve Lead

Q. (1147).—If a marine engine has a given lead (on the top and bottom dead center), is that the greatest lead or full port opening that the valve will have? In other words that lead will not increase as the crank leaves the dead center top or bottom?

A. (1147).—In practice the port opening does increase as the crank leaves dead center. In order that full port opening might exist at dead center or the beginning of the stroke the radius of the eccentric would have to be in line with the crank radius; that is, the eccentric would be on the opposite dead center to that of the crank. Such an arrangement would mean that cut-off would begin with the commencement of the stroke and that all the other operations of the cycle, expansion, exhaust, etc., would take place in their order at a correspondingly earlier point in the stroke than in good practice.

Mean Effective Pressure

Q. (1148).—Don't you think 110.875 pounds is pretty high for a mean effective pressure in the following example? What do you think of the formula?

A marine engine has an absolute pressure of 125 pounds per square inch, with a cut-off of 5/8 of the stroke. The pressure in the condenser is 14 pounds or 28 inches of vacuum. What is the mean effective pressure?

Constant for a 5/8 cut-off from slide rule is .919, then 125 × .919 = 114.875 — 14 or 100.875 mean effective pressure.

A. (1148).—With a vacuum of 28 inches (corresponding to 14 pounds pressure) in the condenser a pressure of, say 3 pounds (known as back pressure) might be expected at the engine exhaust which we will call p. With 5/8 cut-off the number of expansions would be $1 \div .625 = 1.6 = r$.

P_1 = pressure in steam chest = 125 pounds absolute

$$P_m = \text{theoretical M.E.P.} = P_1 \times \frac{1 + \text{hyp. log } r}{r} - p$$

$$= (125 \times \frac{1 + .47}{1.6}) - 3 = (125 \times .919) - 3 = 111.9 \text{ pounds}$$

The value of P_m is a figure which might be expected from a perfect engine having dry steam expanding at a constant temperature. In the actual engine as built there will be losses in pressure due to friction of steam during admission and cut-off, also through ports and passages, condensation of steam due to the cooling action of the cylinder walls and passages, opening of valve to exhaust before piston reaches end of stroke, also compression and back pressure due to lead. All these losses may be taken care of by a factor, the value of which depending upon the type of engine and valve gear, number of cylinders, piston speed, whether condensing or non-condensing, jacketed or non-jacketed. When possible this factor value should be derived from a similarly constructed engine.

For the single cylinder engine under discussion this factor, which we will call F, may be taken as .70. Then the actual mean effective pressure would be

$$P_m \times F = 111.9 \times .70 = 80.4 \text{ pounds}$$

Bottom Blow Valves

Q. (1152).—Please give a brief explanation of the bottom blow valve of ocean going steamships, and a description of each kind.

A. (1152).—The object of the bottom blow valve is to blow out of the boiler into the sea, with the boiler's own steam, mud and sediment which may collect at the lowest part of the boiler, or for emptying the boiler for the purpose of cleaning or examination. In the case of express type boilers where two or more lower drums are fitted, each drum would require its own bottom blow valve.

The valve may be attached directly to the boiler or as is often the case an intermediate blow-off cock or valve may be fitted. The one nearest the boiler being opened wide and an outer valve used to control the blowing-off operation. The valve's location should be at the lowest point; but, if this is found to be impracticable, it may be placed at some higher point with a connecting internal pipe running to the bottom point. This valve in turn is piped to a valve at the ship's shell.

There are so many blow-off valves on the market, that it would be impossible to enumerate their detail differences. They may, however, be divided into four principal types and designated as "seat," "seatless," "gate" and "cock."

The first type is much on the order of an ordinary globe or angle valve in appearance, the seat being easily removable and so designed together with its disk as to eliminate so far as possible the lodging of scale in such a way as to prevent the valve being closed. The valve is so attached that steam is always on top of the disk.

The second type consists essentially of a hollow piston, either with a series of ports around its circumference or an internal elbow passage, and is so constructed that there will be no projection upon which scale or sediment can collect. The pressure is against side of piston when valve is closed.

The third type is essentially a specially designed gate valve which permits of a straight through flow when the disk is drawn up to its open position.

The fourth type is simply a plug cock having a spring or other device on the top side of the plug for holding it securely in place and to take up wear, thus preventing the accumulation of scale and sediment.

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LETTERS TO THE EDITOR

Oil Burners Overtax Feed Water Heaters

I have read with much interest your article in the February number of Marine Engineering and Shipping Age concerning the trial of the S.S. *Independence,* fitted with Peabody-Fisher wide range, one-man control oil burners. This article was much to the point. I note, however, that it states that the low temperature of the feed water was due to the arrangement of the measuring tanks installed on the boat deck.

This arrangement consisted of pumping the water from the hot well up to the measuring tanks, from which it was discharged into a temporary tank on deck, to which the suction of the feed pump was connected. It will be obvious, therefore, that very little loss in temperature in the feed water took place, as the only source of cooling would be a slight amount of radiation during the passage of the water from the measuring tanks to this temporary "hot well."

On the other hand, please note that we were making steam at a rate very much beyond the ordinary requirements and the excess steam was escaping through the safety valves. In fact, during the latter part of the test, more than 62,000 pounds of steam were being generated per hour, whereas the maximum requirements of the vessel were estimated at 45,000 pounds.

Thus the quantity of feed water passing through the heater was far in excess of the normal amount, while the exhaust steam from the auxiliaries entering the heater remained unchanged; the natural consequence being that there was not enough exhaust steam to heat the abnormal amount of feed water above 168 degrees.

This, of course, is no reflection on the design or operation of the machinery but merely an example of the very high capacity at which the boilers were being forced. If the boilers had not been forced, the feed temperature would possibly have been 210 degrees Fahrenheit or more.

I subscribe fully to your comment concerning the effectiveness of the soot blowers. Had they been used earlier in the test, doubtless a still higher efficiency would have been obtained from the boilers. However, I am sorry that you did not add a statement to the effect that very little or no smoke was produced during the trial, as it might appear to the average reader that the boilers were badly sooted up during the trial. This, of course, was not the case.

At about the end of the trial, while the vessel was entering the harbor at full speed, the engineer got a bell to stop and the main engine was immediately shut down. The operation of our wide range control came into service at this time and merely by the turn of one valve on the bypass line all fires were reduced in capacity so that the safety valves were prevented from blowing. At the end of a period of about five minutes the signal "full speed ahead" was given and again, by the turn of the valve, the fires were accelerated and the steam pressure maintained, with the engines developing full capacity.

In other words, it was not necessary to touch any of the burners; none of them was extinguished; cold air was prevented from entering the furnaces (thus preventing contraction strains) and, when starting up again, it was not necessary to get out the torch and light up any burners.

It has been claimed that our flexible system is of no use on merchant vessels, where the load on the boilers is uniform and steady. However, the above incident shows that there are many occasions when the bypass comes into excellent service. No change of tips is necessary when getting up steam on cold boilers. All maneuvering is easily handled by the bypass, and it frequently happens at sea that on account of fog or heavy weather the engines have to be slowed down.

The tanker *Illinois* of the Texas Company has now been in service some eight months, and it has been found that the flexibility of the system is of great advantage.

New York.

Peabody Engineering Corporation,
E. H. Peabody, President.

Marine Boilers

In your issue of September, 1921, there appears an article entitled "The Selection of Propelling Machinery," by Professor Lawrence B. Chapman, in which he, like many other persons, makes comments upon marine boilers which, I believe, are not justified.

He begins the part on boilers by stating that the lighter express types of watertube boiler are unsuitable for merchant service, and ignores the fact that the *Berengaria* (ex-*Imperator*), *Leviathan, Great Northern, Northern Pacific* and most of the "State" ships of the Shipping Board have such boilers and apparently are satisfactory. The forthcoming *Majestic* of the White Star Line also has them and I imagine that many ships in the future will be so provided. The *Berengaria, Leviathan, Majestic* and "State" ships have boilers of the Yarrow type and the *Great Northern* and *Northern Pacific* have Mosher boilers. I have not heard of any trouble from them and it is well known that the two latter steamers, when used for transports, made the quickest round trips between New York and Brest of any steamers.

Concerning Professor Chapman's comments on Scotch boilers, I disagree with him and assert that the Scotch boiler has good circulation after it has once been heated up; that it can be easily forced and that its efficiency is superior to that of any marine watertube boiler. With it it is important to raise steam slowly and to circulate the water artificially while this is being done. When the results of the tests of the 15-foot 3-inch Scotch boiler at the Sun Shipbuilding Company's plant at Chester, Pa., carried out by the Emergency Fleet Corporation in 1920-21 are published, many persons will be enlightened on these matters. They will find that the combustion was excellent, that the economy was unusually high, that the circulation was perfect, as shown by thermometers inserted through the shell at top and bottom, and that there were no drawbacks.

Concerning forcing, what can possibly prevent burning a large quantity of coal in a Scotch boiler, if the draft is sufficient—that is what forcing consists of. The draft, being usually artificial, can be sufficient to force any boiler. Can the Sotch boiler respond with economy when forced? It surely can, and the Emergency Fleet tests prove it, especially when retarders are used. People are misled by the temperatures of the escaping gases from Scotch boilers. They are higher than from watertube boilers because there is no air leakage to cool them as in the case of watertube boilers. This is a valuable feature as the hotter gases are effective in superheating the steam and heating the air with the Howden system.

Is there any reason for anticipating more injury to a Scotch boiler from forcing than from ordinary use? I can see none as the distribution of temperatures is as equable when forcing as when not, and it is the absence of this that causes injury to boilers. Furthermore, unusual forcing of boilers at sea seldom occurs.

By an examination of an article in *The Engineer* of September 23, 1921, on the tests of the Inglis Scotch boiler it will be seen that this boiler surpasses in economy all other boilers in existence, whether on land or sea, even when burning 49 pounds of coal per square foot of grate per hour

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with an air pressure of 3 inches, and apparently without heated air for combustion. The tests of these boilers were made by five different firms or individuals in good standing, and the results were as follows:

Tests by	Coal burnt per square foot grate per hour, pounds	Heat value of coal, B. T. U.	Temperature of escaping gases, degrees F.	Evaporation per pound of coal from and at 212 degrees F., pounds	Efficiency, percent
Burstall & Monkhouse	19.82	14,350	439	12.97	87.34
	27.31	14,280	482	12.24	82.80
	48.89	13,890	523	11.33	78.80
Prof. Stanfield	20.10	14,080	457	12.70	87.58
	33.20	14,080	475	11.82	81.32
	48.00	13,600	524	10.94	77.82
John Brown & Company, Ltd.	38.70	13,647	498	12.08	85.00
	48.90	13,647	593	11.40	80.20
Denny & Company..	16.20	13,864	470	12.87	89.50
	19.00	13,864	410	12.70	88.40
	29.00	13,864	440	12.08	84.10
The Fairfield Shipbuilding & Engineering Company, Ltd.	19.20	13,952	445	12.45	86.21

These results easily surpass any that have ever been obtained from any other type of boiler, when hand fired, and constitute an epoch in boiler performance. The Inglis Boiler Syndicate guarantees 80 percent efficiency, which has never been done before.

The Scotch boiler lends itself to superheating readily, and, by the use of the locomotive type of superheater, to high degrees. Its defects are its cost, weight and space occupied. It is not as sensitive to salt as the watertube boiler, salt being the great enemy of the latter.

Boston, Mass. F. W. DEAN

NEW BOOKS

ELECTRIC SHIP PROPULSION. By Commander S. M. Robinson, U. S. N. Size, 6 by 9 inches. Pages, 274. Illustrations, 140. New York, 1922: Simmons-Boardman Publishing Company.

Electricity as a prime mover for ships has been proposed for many years and a number of excellent papers on this subject have been presented from time to time before technical societies both here and abroad. It has remained, however, for Commander Robinson to present the first book devoted in its entirety to electric propulsion.

The United States Navy was the first to recognize the possibility of electric drive for ships and the author's experience with the design and operation of naval craft so propelled is such as to place him among the foremost authorities on this subject in the world. As might be expected, a goodly portion of the book is devoted to electric drive installations in naval vessels, but the application of this method of propulsion to merchant craft is taken up in no less detail.

Chapter I deals with the history of electric propulsion and the types of ships for which it is best adapted. Comparison of electric with turbine and Diesel installations is made clearly and concisely and deductions arrived at which indicate the type of machinery best adapted for various classes and types of vessels.

Chapter II describes the electrical systems most suitable for marine propulsion and discusses the reasons for different systems in various types of craft.

In Chapter III the characteristics of propellers are dealt with from the viewpoint of the effect of the propeller on the design of the ship's motor. The design of motors and generators to meet the conditions imposed by the propellers is fully treated in Chapter IV, while Chapter V describes the characteristics of turbines and governors for electric propulsion.

Ventilation and heaters as a means of protecting the motors and generators are described in Chapter VI as are also proper fire extinguishing apparatus for preventing damage from fire caused by a short circuit. Switchboards, interlocks and control apparatus are dealt with in Chapter VII, and the proper type and kind of wire, cable, insulators and insulation is given in Chapter VIII.

Chapter IX takes up the installation of exciters and other auxiliaries which are required for furnishing excitation to the main generator field. The next five chapters are devoted to describing in detail the electric drive installations installed in some of the naval vessels including the initial experimental installation in the collier *Jupiter* and the latest improvements as installed in the latest battleships.

A typical installation in a ten-knot cargo vessel of 6,000 tons capacity is described in Chapter XV where the Ljungstrom system of electric propulsion, as applied to the *Wulsty Castle,* is set forth in detail. Chapter XVI is devoted to the description of Diesel electric drive and deals with the future possibilities of this type of prime mover for merchant vessels, while the concluding chapter describes the care and upkeep of electric propulsive units and gives a number of practical hints which will aid in keeping the machinery in proper working order.

Commander Robinson's book has been skilfully prepared and its value is greatly increased by the many illustrations showing actual details of existing installations. The increasing trend of modern practice in the direction of the application of electricity as a prime mover for ships has created a demand for an authoritative text-book on this subject which is fully met by this book. It should have a place in the libraries of all students of modern marine engineering.

PERSONAL MENTION

GEORGE H. WELLS, of the traffic department of the Shipping Board, is to be appointed to the executive staff of the United States Lines.

FRANCIS M. WOLF, who has been assistant passenger traffic manager of the Munson Steamship Line, has been made passenger traffic manager.

J. T. BORDEN, formerly of Chester, Pa., has been placed in charge of the recently opened New York office of the Sun Shipbuilding Company at 25 Broadway.

GALE H. CARTER, a director of the Pacific Mail Steamship Company since last September, has been elected president of the company to succeed George J. Baldwin.

GEORGE J. BALDWIN, president of the Pacific Mail Steamship Company, has been elected to the newly created office of chairman of the board. Mr. Baldwin's resignation as president will relieve him of the active management of the company, which he has had for the past six years.

R. H. M. ROBINSON, chairman of the executive committee and, during the past year, acting president of the United American Lines, has been elected president of the company. At the same time A. D. Tomlinson was elected vice-president. Mr. Tomlinson is vice-president of the American-Hawaiian Steamship Company, for which the United American Lines are managing agents.

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GEORGE G. MCINTOSH, formerly passenger traffic manager of the Munson Steamship Line, will assume the duties of European service manager for this company.

R. I. DUNIGAN has been named as successor to Edward Wortmann as assistant general passenger agent of the United States Lines. Mr. Dunigan was formerly traffic director for the Baltic Steamship Company.

M. J. BUCKLEY, assistant to A. J. Frey, vice-president of the Shipping Board, has resigned and intends to return to San Francisco, where he was formerly connected with the Pacific Mail Steamship Company.

CHARLES F. GROSS of Baltimore, Md., has been made assistant professor of marine engineering and naval architecture at the College of Mechanics of the University of California, Berkeley, Cal. Professor Gross graduated from the department of naval architecture and marine engineering of the Massachusetts Institute of Technology, after which he became instructor at the United States Naval Academy, Annapolis, Md., in the department of marine engineering and naval construction. For some time after the war he was associated with the Union Shipbuilding Company, Baltimore, Md. Professor Gross is a member of the Society of Naval Architects and Marine Engineers and of the American Society of Naval Engineers. The course in naval architecture with which he is connected at the University of California was started in January, 1918, under the instruction of Professor D. W. Dickie, a well known naval architect on the Pacific coast.

Charles F. Gross

ERIC KRAG has been appointed manager of the newly formed chartering department of the General Steamship Corporation, San Francisco, Cal. He was formerly connected with the East Asiatic Company in Copenhagen and came to this country in 1914 as assistant general Pacific Coast manager of the company.

J. P. SUTHERLAND has been appointed eastern passenger agent for the Pacific Mail Steamship Company with headquarters at 10 Hanover Square, New York City, to handle the newly established San Francisco-New York service of the company. Mr. Sutherland was formerly manager of the passenger and mail section of the United States Shipping Board.

J. L. ACKERSON, president of the Atlantic Coast Shipbuilders' Association, has been named a member of the committee recently formed by the Chamber of Commerce of the United States to consider policies to be adopted in connection with the American merchant marine. The committee is made up of men prominently identified with business and shipping interests.

JAMES W. BORING has been appointed manager of the advertising department of the United States Shipping Board Emergency Fleet Corporation to succeed M. B. Claussen who was forced to resign this position on account of ill health. Mr. Claussen, however, will remain in the employ of the Shipping Board, supervising the development work of the various transpacific passenger services on the Pacific coast and in the Orient.

P. J. PEARCE was recently elected president of the Puget Sound Maritime Circle. Mr. Pearce has been acting president of the organization for some time. The Maritime Circle comprises staff employees of steamship and transportation companies in Seattle.

JOSEPH SCOTT, assistant general manager of the States Marine and Commercial Company, New York, has resigned this position to become manager of the steamship department of the Transmarine Corporation, a subsidiary operating company of the Submarine Boat Corporation.

E. E. MACNARY has been named by General Manager Rossbottom of the United States Lines to succeed J. M. Kennedy as general passenger agent of the company. Mr. Kennedy was recently transferred to London to act as European passenger agent for the lines with headquarters in London.

GEORGE W. STERLING, former assistant director of operations of the United States Shipping Board at New York, was recently elected president of the Foreign Transport and Mercantile Corporation. Mr. Sterling while with the Shipping Board acted as receiver for a number of companies which had bought Shipping Board tonnage and defaulted on their commitments for the vessels.

CAPTAIN EUGENE O'DONNELL, manager of the marine department of C. H. Sprague and Sons, Boston, Mass., has resigned as chairman of the committee on sea-going personnel of the American Steamship Owners' Association. President Raymond of the association has appointed A. J. McCarthy, vice chairman of the committee and manager of the American flag steamers of the International Mercantile Marine Company, to this post.

ROBERT TAYLOR MERRILL has become director of the Bureau of Research of the United States Shipping Board. Mr. Merrill, prior to coming with the Shipping Board, was connected with the Oriental Navigation Company, in the capacity of operating vice-president. He is a graduate of the United States Naval Academy and during the war was supervisor of the United States naval auxiliary reserve, charged with the supervision of the officers and men of the merchant marine enrolled in the Navy. He was also district supervisor of the Naval Overseas Transportation Service, in charge of the physical handling of supply ships running to Europe. On his resignation from the Navy in 1919 he held the rank of lieutenant commander. The Bureau of Research will conduct investigations into maritime matters, making studies of world shipping and shipbuilding conditions in relation to their effect on American shipping.

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Robert T. Merrill

NATHAN A. SMYTH has been named as general counsel of the Emergency Fleet Corporation. The object of Mr. Smyth's promotion to the position of general counsel is to bring about a segregation of the legal work of the Shipping Board from that of the Fleet Corporation. Before becoming assistant to Elmer Schlesinger, general counsel of the Shipping Board, last July, he was associated with the law firm of Rushmore, Bishbee & Stern of New York. He was born in Quincy, Ill., in 1876, graduated from Yale in 1897 and the Yale Law School in 1900.

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